MAY 1982
75p

COMPUTER & VIDEO GAMES

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MONOPOLY
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COMPUTER & VIDEO GAMES

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Find out how to enter these increasingly popular fantasy worlds — and what's in store for those who do. Also a chance to take part in a game for free.

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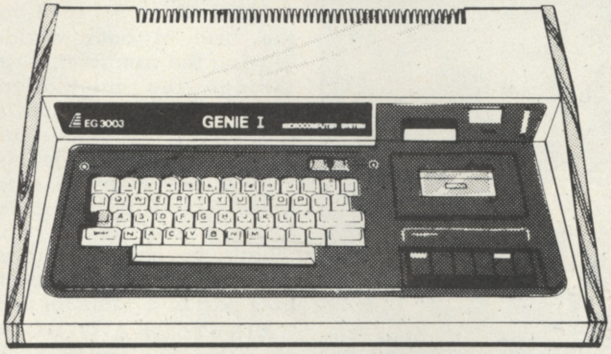

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HOW WOULD YOU FARE IN THE WORLD CUP?

NEXT MONTH

June will find normally mild-mannered men vehemently pushing forward half-believed theories as indisputable facts. Gesturing wildly with beer-glasses and shouting down conflicting opinions with a bigotry which belies 50,000 years of civilisation.

Yes, you guessed, the World Cup is with us again and love it or adore it — it's difficult to close your eyes to it.

Already the arguments rage with the Hoddle Walks on Water school, battling against the He Couldn't Kick His Way Out of a Paper Bag theorists. Northern Ireland is dogged with the Martin O'Niell question and Scotland — which has seen it all twice before in the last eight years — is gearing itself up for the Jordan or Gray debate.

It's certainly a hot topic in Argentina and probably causing quite a furore in El Salvadore. But if the facts don't finally support your views then **Computer & Video Games** can help you take the matter into your own hands.

If you feel England would have qualified from their group if only Greenwood had followed your advice for the team against France then you will have the opportunity to prove it next month when we publish our World Cup Manager game.

You can choose to manage any of the 24 sides, pick your team, play your matches and find out how you've fared. Send out your scouts to watch the opposition, brief your team on tactics, discover the danger men in the opposition and make arrangements to mark them.

Winning with Brazil or West Germany is a hard enough task but anyone who can do it with El Salvador will really have proved their management potential. We think it's a winner, see what you think next month.

● Everyone will be a winner with our World Cup competition. The Silica Shop is putting up the Atari T.V. Games Centre and football cartridge for the first prize but there are also consolation prizes and everyone who enters will receive a £3 voucher to spend at the Silica shop.

Find out how to enter and test your football judgement in our June issue.

NEXT MONTH

If the spirit of Adventure is lurking in your veins, you'll find plenty of ideas in our June issue.

We have four very different adventures featuring next month. From outer space thrills in the **Star Wars** mould with Dog Star Adventure down to the depths of the earth for a very different kind of challenge in the hunt for Trolls Gold.

Or you could Save the Princess in another short adventure game for Atom owners.

When the BBC lends its name to a product it has to be special and the microcomputer that bears its name falls into that category.

If you own one already, have one on order, or just have a healthy interest in the machine, you'll want to read our special section on this highly rated microcomputer — including three of the first games created for it.

Commodore's VIC-20 is now in the high streets and selling well. The company is supporting it with some high quality games cartridges and a growing range of peripherals. A complete rundown on this popular micro takes place in next month's Hardcore section.

NEXT MONTH

The response to our first issue's free cover puzzle caught us on the hop. This time we think we're ready for you — and we've also set you programmer/puzzlers a slightly more challenging task.

There's another free puzzle, from the people at Pentangle, going on our June front cover and although you won't need a computer to solve it — we hope you'll use one to enter our second competition. Even if you don't win you should emerge a better problem solver for trying.

The Beat-the Bug puzzle will make **Computer & Video Games** stand out even more on your local newsagent's shelves. But why not make sure of your copy by subscribing now.

I would like to take out an annual subscription. I enclose a cheque/P.O. for £10, (£20 overseas) for twelve issues. Computer & Video Games, Bretton Court, Bretton, Peterborough PE3 8DZ.

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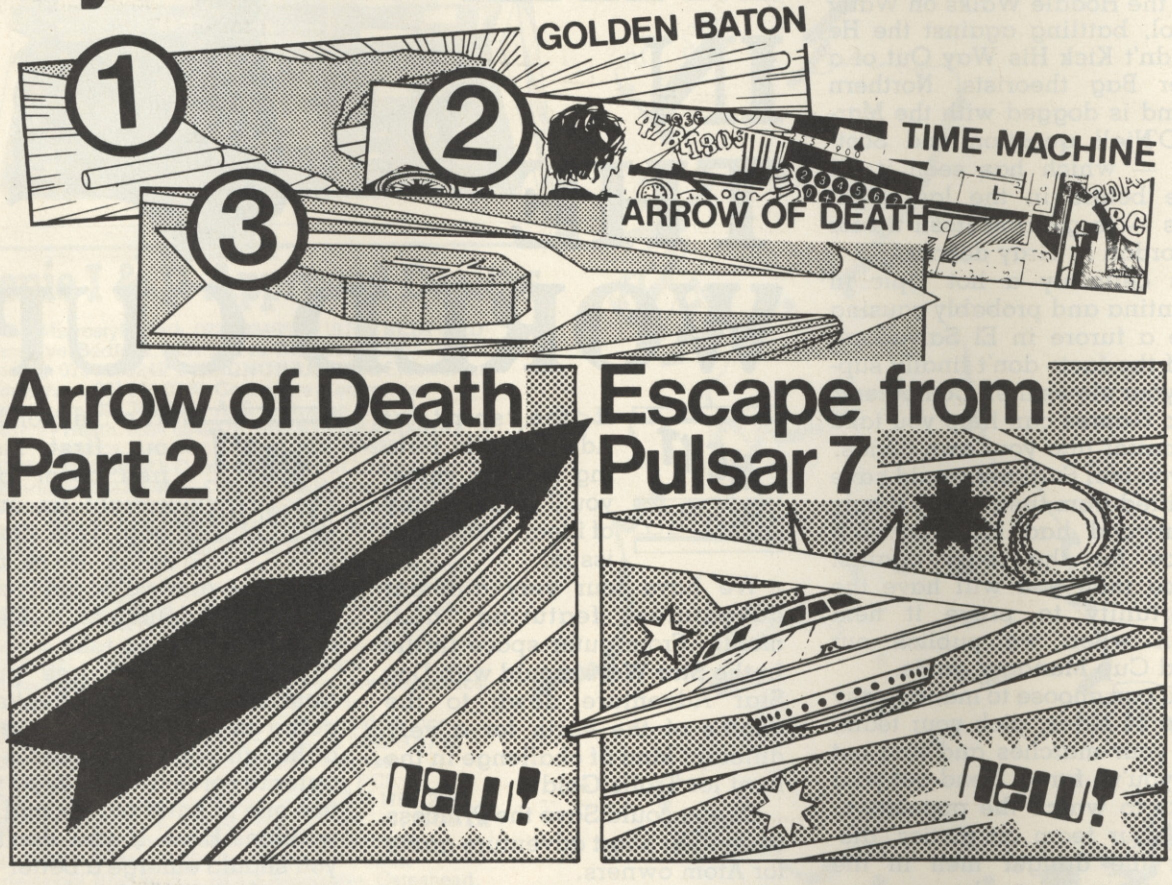
Mysterious Adventure



NOW — The second part of Arrow of Death plus a new Adventure! Escape from Pulsar 7 is the first space Mysterious Adventure. Arrow of Death Part 1, already said to be one of the best 16K Adventures written, is surpassed by the Part 2 edition. Arrow 2 carries on from Arrow 1 but is self-sufficient. In Pulsar 7 you will be delivering Redennium ore to an outer galaxy when you pick up an interesting creature for the intergalactic zoo on your home planet, but what happens when the ore and the animal inadvertently come together?

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MAILBAG
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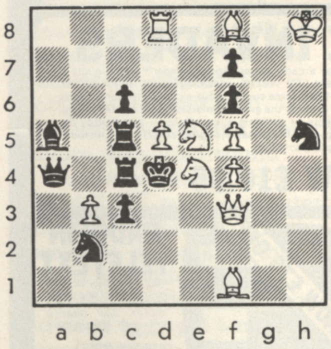
THE LOST KING . . .

Dear Sir,
I own a chess-playing computer and always read your page on this game with interest.

In the April issue, I was delighted to find an opportunity to test my own machine by inputting the problems which Max Bramer had illustrated. However the third diagram, which illustrates a problem solved by the Sci Sys Mark V, is missing a black king — no wonder it defied solving by problemists!

D. Josephs
Oban
Scotland

Editor's reply: The diagram is not only minus a black king, it is also the wrong way up. A correct version is printed below which will still prove a real test of any chess problem solvers — or their machines!



LANGUAGE PROBLEM

Dear Sir,
Would you please answer a question for me? I will shortly be getting a Vic-20 which I ordered from the United States. What I would like to know is if programs produced for British standard Vic-20's will run on U.S. standard Vic-20's. Is the Basic the same?

The command I am wondering about most of all is the colour command. If the Basic is not the same the U.S. Vic would have "COLOR" where the British Vic would have "COLOUR". If this command is different will the tape still load so it can be listed and changes made?

I hope I can use British produced tape as there are many excellent game programs in your magazine for the Vic-20.

Michael B. McAllister
RAF Lakenheath
Suffolk

Editor's reply: You should have no problems Michael as all Vic-20s are imported from the U.S. anyway so there's no such thing as a British standard version. The Basic is standard so you should be able to use British produced games tapes.

WAITING TO INVADE

Dear Sir,
I am very pleased to say that I have thoroughly enjoyed all the issues of **Computer and Video Games** since the first one issued in November.

Every month I look forward to reading your magazine in search of a review or an advertisement for Space Invaders for the VIC-20, but I have been bitterly disappointed every time until your latest issue — March — in which on page 83 I saw an advertisement for it.

I am not too sure whether I should buy.

So could you please help me and all other VIC owners in search of VIC Invaders by providing some information.

K. S. Arom
Tarbock
Liverpool

Editor's reply: The Commodore cartridge Avenger is one of the best computerised Space Invader games you'll find Mr. Arom. It is available from their dealers at £17.35 + VAT.

GRAPHIC DISPLAY

Dear Sir,
I am writing in the hope of adding enlightenment to all graphically frustrated ZX81 owners.

In reply to DK'tronics advertisement — page 63 of your February edition— I received their 4K graphics ROM. It is a very neat Eprom based circuit that fits under the ZX-81 keyboard.

To date I have converted your Cosmax and Cosmos Landing programs and, by insertion of loops within the program loops, have obtained some hilarious slapstick type movement of wings, arms and legs.

While on the subject of Cosmos Landing may I give my congratulations to the co-authors on an excellent program. More of the same quality please — via a ZX-81 user perhaps?

R. N. Leathers
Bassingbourn
Herts.

MORE FOR THE VIC

Dear Sir,
I am requesting more Vic-20 programs. The Vic-20 computer is becoming more and more popular and may — I dare say? — taking over the ZX-81/ZX-80. I know many people in and out of school who have this box of tricks — I, unfortunately have not — and often have access to the use of a Vic-20 would like to see more games for it using all its qualities — sound, colour and good graphics.

Having all but one issue I have played Pot Shot which I enjoyed but am disgusted to only see one game, where as the ZX-81 has had six games, Apple computer one and in each issue of your magazine. Do please, please have more games for the Vic-20.

Clive Young
Luton
Bedfordshire

Editor's reply: We will be running more Vic-20 programs Clive, in fact you'll find one in this issue — and we promise not to ignore your favourite machine.

DODGEM DODGE

Dear Sir,
Modifications to allow your *November Acorn Atom Dodgems* program to run without floating point ROM:

```
A) 11125: remove
   "COLOUR 2;"
   11250: remove
   "COLOUR 1;"

B) 20, 40, 60, 80: in each
   alter
   "S = S + SGN (T-S);"
   to GOSj; S=S+K; and
   add
   30000j K=T−S; IFK=0
   R R
   30010 IFK>0 K=1;R
   30020K=−1;R
C) During debugging,
   remove end of line
   10000 from "?16=.....'
   (Inclusive)
```

Tom Boyd
Holmbury St. Mary,
Dorking,
Surrey.

P.S. D) 11125 should be CLEAR Z, not 3 — Congratulations on an otherwise high standard of bug-free code!

John Dyson replies: Thank you for your modifications for running Dodgems on a machine without the floating point ROM. It should also be possible for you to run the program in colour by using the routine on page 89 of Atomic Theory and Practice.

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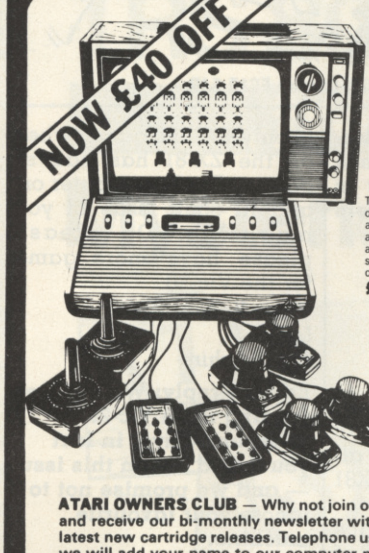

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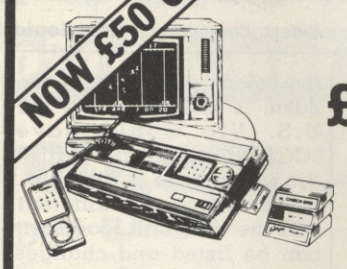

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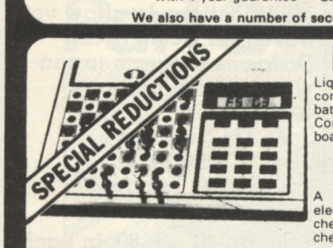

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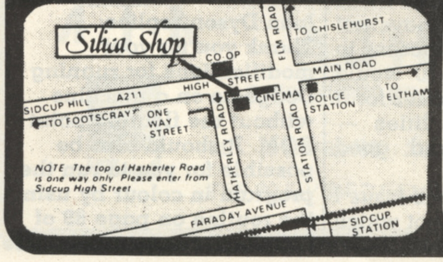

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MAILBAG

SINCLAIR SELECTION

Dear Sir,
I have a Sinclair ZX-81 without a 16K RAM pack, and have bought the last few editions of your generally excellent magazine. My only complaint is the lack of 1K games that you have recently printed.

I think the best idea you can adopt is to print both a 1K and 16K program, pleasing both 1K and 16K Sinclair owners. I am pretty sure that there are many other frustrated 1K owners who would like to see this idea being carried out.

Patrick Morrow
Madeley
Shropshire

Editor's reply: We feature four Sinclair 1K games in this issue Patrick and we hope you'll enjoy playing them. And yes, there will be a 16K game coming up in the near future.

SOUND ADVICE

Dear Sir,
I read in your Sounds column of the December issue of **Computer & Video Games** that: "It is always possible to connect the computer to your hi-fi auxiliary inputs and thereby obtain amplified sound".

I have a Tandy TRS-80 Level II 16K microcomputer, and only recently, quite by accident, discovered that it had a sound facility.

At the Tandy shop I was advised to buy a small amplifier with a 3" diameter loudspeaker. They said that a direct connection from the tape outlet to my hi-fi would be dangerous, as spike outputs from the hi-fi could damage the computer chips, and this was later confirmed when I contacted a friend who is very knowledgeable in these fields.

Yet at another shop a salesman, when I was discussing the purchase of a non-U.H.F. V.D.U., said that he could incorporate the sound facility in a converted U.H.F. television by making a one-wire connection across the DIN-plug video output on the computer.

I am now quite bemused. I would like to purchase such a converted U.H.F. television, as I would then have the advantage of portability together with a sound facility, but I would also like to use my hi-fi at home, as I would get much better sound. But I fear that either course might lead me to accidentally damaging my computer. Can you advise?

Leslie Tebb,
Bradley,
Huddersfield.

David Annal replies:
It is always wise to consider any damage that might be done to a computer by connecting it to anything else. The safest method of avoiding trouble is to separate the computer completely from the following circuit.

This can be done by using opto-isolators. These are small light-proof chips containing a light emitting diode and a light sensitive transistor. Information is transmitted by light and no physical connection exists between the two circuits. This method is ideal for driving relays, thyristors, plotters, etc, but the fidelity is not high enough for good sound transmission.

Another way is to use some form of buffer circuit such as a Darlington driver chip like the 307-109 from Radiospares. Unfortunately there are seven drivers on one chip and eight lines out from the average computer bus! By interspersing an extra chip between the computer and the outside world, all that could happen would be the need to replace this and not one of those in the computer itself.

A much easier way to protect the computer is to simply use a series resistor. Any computer line configured as an output should ALWAYS have a series resistor placed immediately in the wire next to the computer port before any external circuit is connected to it.

Resistors of 1K are usually adequate, but in the case described above, one of 100K is better and will not affect the output overmuch. Place this in series with the signal wire from the cassette port, or DIN socket, and no harm should come to the computer.

Note, however, that some hazard can arise when connecting T.V. sets direct to the computer other than via the usual UHF aerial socket. Many such sets have a "floating chassis" which is not earthed. To earth it through the computer digital ground or by taking a line direct to the earth pin of your mains is highly dangerous, however, a competent T.V. engineer should be well aware of this point.

READER'S APPEAL

Dear Sir,
You have a great magazine but I feel I must complain about the programs sent in by some readers.

I own a ZX-81 and ardently keyed in the program for Reversi, featured in your March edition. This I did despite there seeming to be an error in the machine code statement, where is the 3Q"s in line 5?

Why is there such apathy among the ZX-81 owners, after all I have managed to key in and successfully run programs for other computers, after changing them to ZX-81 basic.

Congratulations on an otherwise excellent magazine.

P. J. Jinks,
Chessington.
Surrey.

COSMOS FAULT

Dear Sir,
I have enjoyed playing your Cosmos Landing program very much and was able to correct the mistakes pointed out in your March issue without any great difficulty. I am surprised however to discover that Mr Wiel has not also spotted what I would consider as a major routine fault. The variable I assigned in lines 130-140 has no effect whatsoever on the descent rate. The fault lies in line 320 and I found replacing this with LET S=S+1/I very effective in solving the problem. I am not sure that this is the original line intended, but I feel that the fault should be made known to your other readers as it improves on otherwise brilliant game.

S. W. Stewart
Westway Gardens
Belfast

DEFENDER ON APPLE

Dear Sir,
I read in the January issue of Computer and Video Games the articles on the arcade game Defender, which interested me greatly, as I play the game myself. As I have access to an Apple 11 computer, I was wondering whether you might know if a version is being brought out on a disc or cassette in the foreseeable future, or even if a similar game is available. I hope you can help me with my query.

J. S. Heppell,
Ingatestone.
Essex.

Editor's reply: There is an Apple II version of Defender on sale in the UK. It is an American written game by Sirius Software and you can obtain a copy of it from most Apple software dealers, including SBD Software of Richmond. The game is called Gorgon and according to the latest price list it costs £24.95.

AMERICAN DREAM

Dear Sir,
We are considering going to America for our holidays this year. Is it possible that if we buy an Atari 800 computer — which costs a lot less in USA — we can use it in Britain with our T.V. system?

Also is there duty payable at Customs, if we declare the purchase of such a computer — or are they exempt?

Adrian Morris
Cardiff

Editor's reply: Sorry Adrian, the American Atari 800 is not compatible with the British T.V. system — so your American dream will not be coming true.

MAILBAG

FROM THE BATTLEZONE

Dear Sir,

To my mind, people are attracted to arcade games subconsciously, for they often get out far more than they put into these computers.

Take Atari's Battlezone. It caught my eye in a fish'n'chip shop because of the XY monitor with vector scans, and the prodigious amount of maths the computer gets through in real time. In case you haven't met it, it's a fighting tank simulator in which you drive around a valley dodging missiles and rocks. Everything is portrayed in full perspective, right down to the missiles flying longer to distant targets.

A kind man let me mend one. There's a 6502 riding a 12K program, plus four custom bit-slice chips doing 16-bit trigonometry, among the 150 other support devices. She certainly puts out more than you put in. At a guess the software came out of the backdoor from NASA, Boeing and Lockhead.

Thought your readers might be interested.

Jonathan Pope
Chesterton Road,
Cambridge.

JUMBLED ADVENTURE

Dear Sir,

I have an Atari 400 computer with a microtex 32K card in it. Please could you help me with a problem I have. When I run Scott Adams adventure games, 1, 2, and 3, 90 percent of the time when I run the games they are all right, but sometimes when I press the return key, the screen is covered with jumbled-up letters and then after about two seconds, the screen either goes black or yellow and black with machine code symbols.

The only way out of this is to turn the power off and to start again. I have also tried the games on an Atari 800 and the same thing happens.

I would just like to congratulate you on the marvelous reading that your magazine offers.

Mr J Harrison,
Millbrook,
Southampton.

Editor's reply: 'I'm afraid that you either have a faulty cassette containing the game, or a faulty computer. I suggest you take your computer to your supplier and get him to give it an overhaul to see if anything is wrong.

Unfortunately, the Microtec 32K card is not one which either Atari or Ingersoll supports for use with the Atari.

If you have not already tried returning the games to the supplier in case they are at fault, it would be a good idea to do so.

TUNE IN TO THE BBC

Dear Sir,

I have ordered a Model B, BBC microcomputer which is due in March. Please could you inform me whether a BBC Users Club is planned to be formed in the near future?

Jonathon Freeman
Finham
Coventry

Editor's reply: Here are a couple of addresses you may find useful Jonathon.

The ZX-80/81, Acorn Atom and B.B.C. Micro-user Club can be contacted by writing to Tim Hartnell, 44/46 Earls Court Road, London W8. This club produces a magazine called Interface which includes programs for the B.B.C. micro.

The Beebug User Group can be found at 35 St Julians Road, St Albans, Hertfordshire and D. E. Graham is the person to contact.

COUNTING ON COMMODORE

Dear Sir,

As most people know, the Commodore's Pet computer uses a cassette recorder for storing programs on tape. This is very inconvenient, if you have a long program to save or load.

This is a drawback we have to put up with, but another problem, which crops up when saving programs on tapes, is how to find programs in the middle of a tape.

This problem can be overcome by using a tape counter, so it is possible to record the number the program is at. Will we be likely to be seeing Pet computers with tape counters, in the near future?

Andrew Zucker,
Finchley,
London.

Editor's reply: Your idea for a tape counter is a good one, but Commodore claims it has beaten you to it. I don't know what make of cassette recorder you have but the standard Commodore compatible one is the C2N which already has a counter.

SOUND AND VISION . . .

Dear Sir,

Well, I'm lost for words! All I can say is that yours is one fantastic magazine. But also even with all your excellent advice I am still unable to create my dream game, which, when finished I might let you see. To tell the truth I haven't started yet but with your help, who knows?

I am presently using an Apple II. I have searched the manuals high and low in order to find some good sound effects. All I have achieved so far is a loop around a line like

```
PEEK (−16336) −PEEK
 (−16336) + PEEK (−16336).
```

Are there any other ways of getting sound from the Apple because this sounds horrible. Not exactly your ideal laser gun sound.

I am also experiencing problems in High Res Graphics. I am presently using a shape from a shape table with the command.

```
DRAW 1 AT 10, 10
```

This works fine but I would like to know how to make the shape move by pressing a key on the keyboard and for that shape to continue moving until that key is released. Another problem I have is how to make the aforementioned shape explode or disappear when touched by another shape e.g. a missile.

Is there any way your dedicated readers could help me and I'm sure many others like me? Please, please write in because I'm really desperate.

I'm sure many readers with Apple's without paddles would like to know how to convert the Dogfight by Mark Pelczarsk in the February issue in to a keyboard operated version.

Paul Cainey
Exeter,
Devon.

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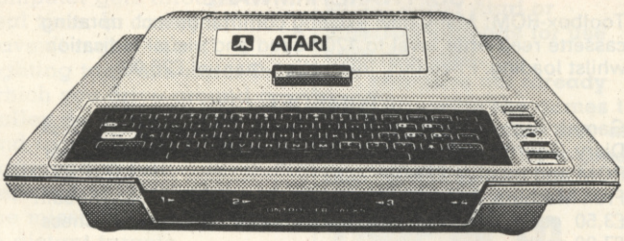

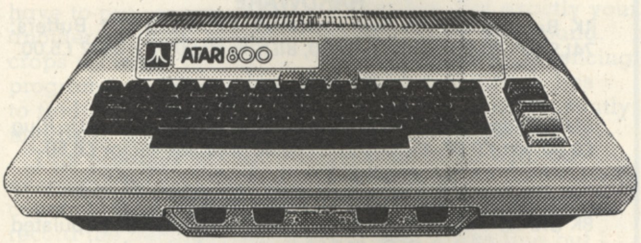

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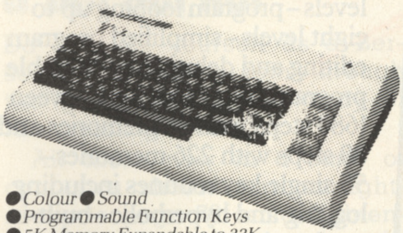

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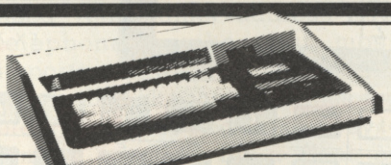

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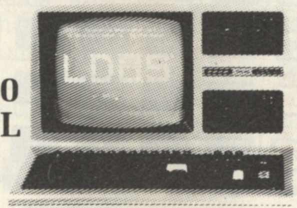

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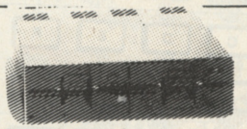

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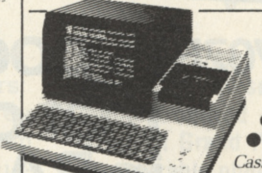

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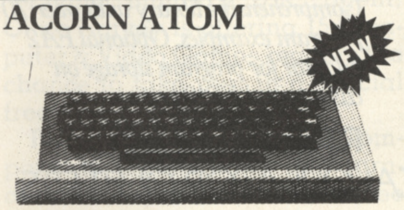

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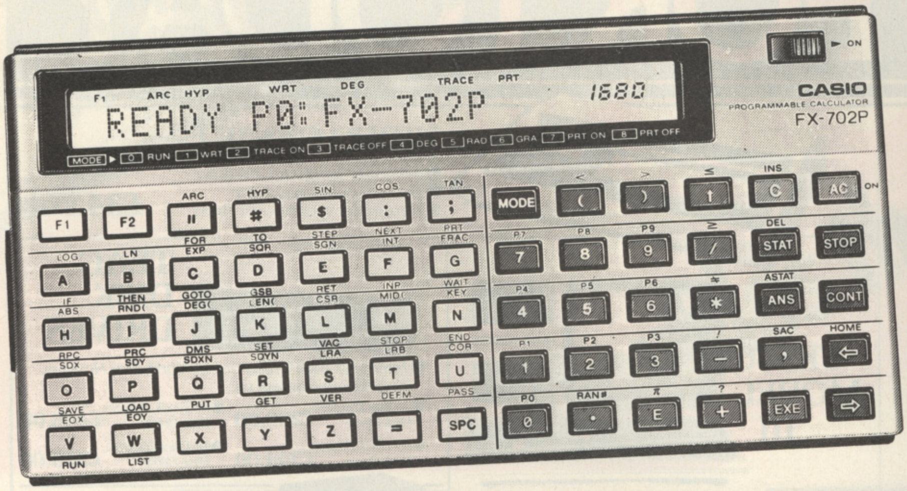

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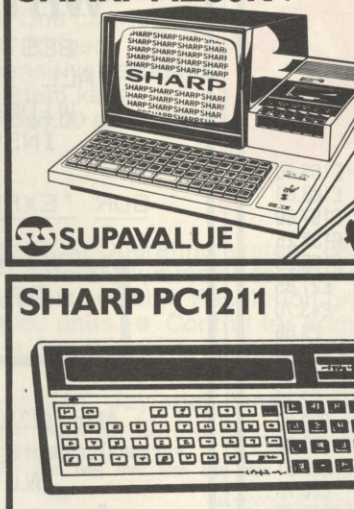

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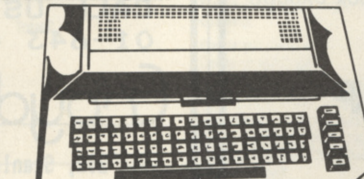

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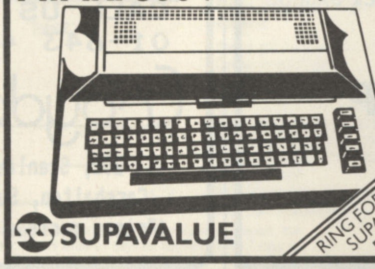

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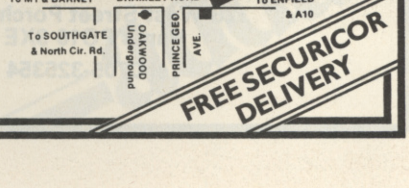


FREE SECURICOR DELIVERY

Would you make out as a berserker

Do you see yourself as a Berserker, spreading fear through the galaxy with your army of life-crushing robots?

All those now in a state of confusion should turn straightaway to page 70 for enlightenment. If you have already digested our double page spread on computer moderated gaming then you will be ready to carry on.

Flying Buffalo's U.K. agent, Chris Harvey is offering 15 Computer & Video Games readers the chance to take part in a special free game of Starweb.

It's special because the company is promising a fast turnaround so you'll be able to see the results of your orders without having to wait the usual four weeks.

The computer is running off the first few turns of the game, so that you begin the game already involved in the action. We will also be following your fortunes in the magazine with a regular column devoted to the deals, battles, hopes and fears of the players.

If you would like to join in, write, telling us which of the six character types you would like to play: Berserker, Apostle, Pirate, Artifact Collector, Empire Builder or Merchant.

Choose a species name for your race which fits the character type you have decided on. And the first 15 imaginative names we receive will be given a place in the game. We also need your name, address and telephone number but most importantly we need 15 people who will make the deadlines for orders, not lose heart if their system is invaded by a fleet of Berserkers and be willing to write the occasional piece about the game for inclusion in the magazine. So be quick off the mark with your letter.

We need your games

Calling aspiring games writers:

If you think your games deserve a wider audience then send them in to us with instructions, a list of variables, and other helpful information to aid our readers in the understanding of the game.

No matter what machine you want to write on, we'll try and get around to publishing your game. A printout is what we will eventually need but we can make do with a tape — which also helps us try the game out — and get the game printed from that.

Our thanks to all those who have sent games in to us so far but there are some machines we would like to continue to support and we are running short of good games for.

Remember we pay £10 for each listing published and there's also a chance of winning a trip to Paris if your game is voted the best of the year.

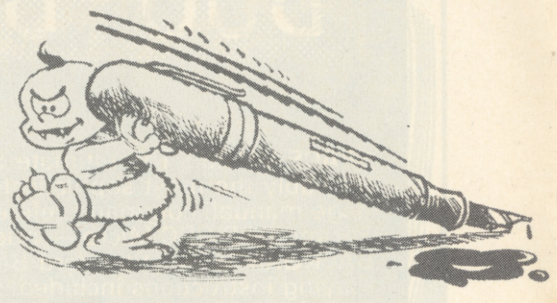
BRAINWARE ANSWERS

The answer to our April Mind Routines problem is 1789 bags divided as follows: first man 589, second man 477, third man 393 and fourth man 330.

The correct solution to last month's Nevera Crossword is printed right and the winners' names will be published in next month's issue.

For more puzzles to tax your mind turn to page 81 for this month's Mind Routine and Nevera Crossword.

1 R	2 E	A	D	3 O	N	4 L	Y	■	5 P	6 O	K	7 E
■	V	■	■	N	■	I	■	8 D	■	R	■	N
9 H	E	X	■	10 E	N	Q	U	I	R	I	N	G
■	N	■	■	■	■	U	■	N	■	O	■	I
11 A	S	12 T	13 E	R	O	I	D	S	■	N	■	N
■	■	14 A	T	■	■	D	■	■	■	■	15 P	E
■	16 A	B	A	S	I	C	N	O	17 V	18 E	L	■
19 W	P	■	■	■	■	R	■	■	20 I	M	■	■
I	■	21 C	■	22 R	A	Y	B	L	A	S	23 T	S
N	■	O	■	A	■	S	■	■	■	■	O	■
24 D	E	D	I	C	A	T	E	25 D	■	26 S	K	I
O	■	E	■	E	■	A	■	O	■	■	E	■
27 W	E	S	T	■	28 P	L	O	T	T	I	N	G



Confessions of a Bug

There are times when we Bugs surprise even ourselves. The February edition offered the Tandy TRS-80 game of Grand Prix which generated innumerable phone calls from readers who claimed various assorted gremlins in the program — but we never touched it! Honest!

The most popular theory expounded was that disc based instructions made it impossible to run with a cassette. But after thorough testing (a Bugs' curse on John Gibbs of Dover) it has been proved to everyone's satisfaction that the game works perfectly well on both disc and cassette.

The problems seem to relate to the data statements and making sure you distinguish between a "B" and an "8" in these. Also check the letters "D" and "O" in the program. A program which includes a line to check the data entry is available from Computer & Video Games for anyone still having problems with this game.

The ZX81 Poker game in our April issue caused plenty of phone calls from observant programmers who spotted an IF statement in line 3530 with no THEN attached.

The line is correct as far as it goes but continues:

```
=J(4)ANDJ(2)+2=J(3)+1 THEN LET
T4=1234
```

This game does in fact work without the missing line until you get three of a kind up — and so slipped through the rigorous testing the editor put it through.

The Moon Lander caused a few problems as a rogue symbol appeared in the printout in line 360. It was a colon — as most of you seemed to guess. The line should read:

```
360?I=?I:128:N.
```

yours Mal

BUG-BYTE

B.B.C. MICRO **VIC**
ZX81 **ATOM**

B.B.C. MICRO

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ZX81

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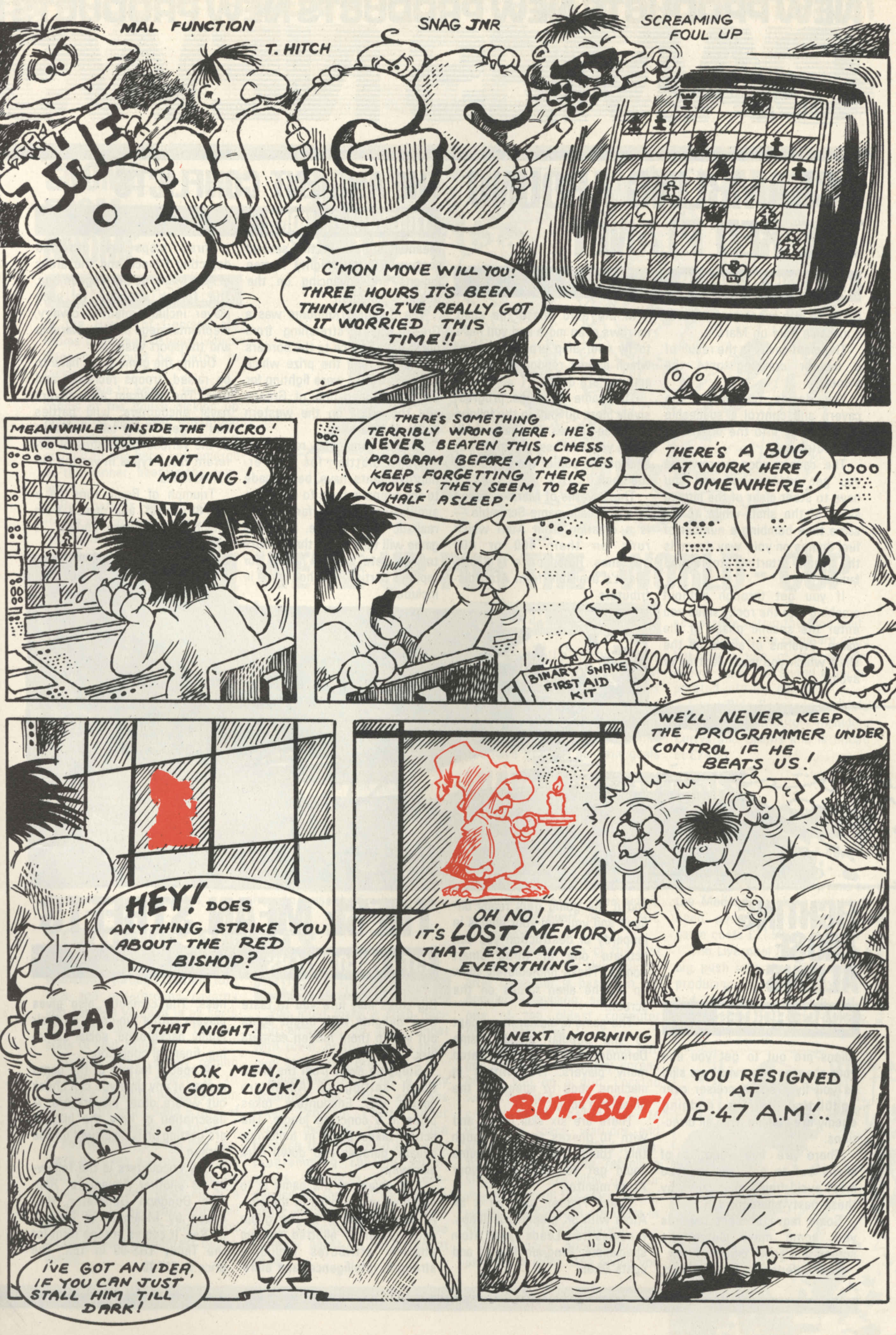
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THE
C'MON MOVE WILL YOU! THREE HOURS IT'S BEEN THINKING, I'VE REALLY GOT IT WORRIED THIS TIME!!
MEANWHILE... INSIDE THE MICRO!
I AINT MOVING!
THERE'S SOMETHING TERRIBLY WRONG HERE. HE'S NEVER BEATEN THIS CHESS PROGRAM BEFORE. MY PIECES KEEP FORGETTING THEIR MOVES. THEY SEEM TO BE HALF ASLEEP!
THERE'S A BUG AT WORK HERE SOMEWHERE!
BINARY SNAKE FIRST AID KIT
HEY! DOES ANYTHING STRIKE YOU ABOUT THE RED BISHOP?
OH NO! IT'S LOST MEMORY THAT EXPLAINS EVERYTHING..
WE'LL NEVER KEEP THE PROGRAMMER UNDER CONTROL IF HE BEATS US!
IDEA!
THAT NIGHT.
O.K MEN, GOOD LUCK!
I'VE GOT AN IDEA, IF YOU CAN JUST STALL HIM TILL DARK!
NEXT MORNING
BUT! BUT!
YOU RESIGNED AT 2·47 A.M!..

GAMES NEWS

SCRAMBLING AROUND THE RED PLANET

CAVERNS OF MARS

On a trip into space you discover a massive hole on Mars.

The giant cavity is the result of a meteor crashing onto the planet.

You decide to explore the cavern and control a spaceship on a journey into the depths of the red planet.

The cavern soon narrows as you get underground and you have to steer clear of the jagged sides of the shaft while at the same time bombing a number of fuel dumps on your way down. Is the game starting to sound familiar?

If you get through without crashing into the rocky sides you enter the second phase of the game. Swarms of aliens fill the shaft which you must destroy or avoid.

In the third phase the shaft narrows even more and you have to fly your ship around barriers which appear randomly. Hit one and you are dead.

The game becomes progressively more difficult in the following three phases. The game ends when you successfully land your ship on the pad at the bottom of the shaft.

The Caverns of Mars — based on the Arcade game Scramble — is a creation from Atari which runs on their 400 or 800 machines. Retail price is £29.95 and it's available from Atari distributors.

THE ANCIENT CONFLICTS

TRIUMPH OF ROME

Meanwhile back in the second century BC the mighty Roman legions are advancing on the Seleucid Kingdom.

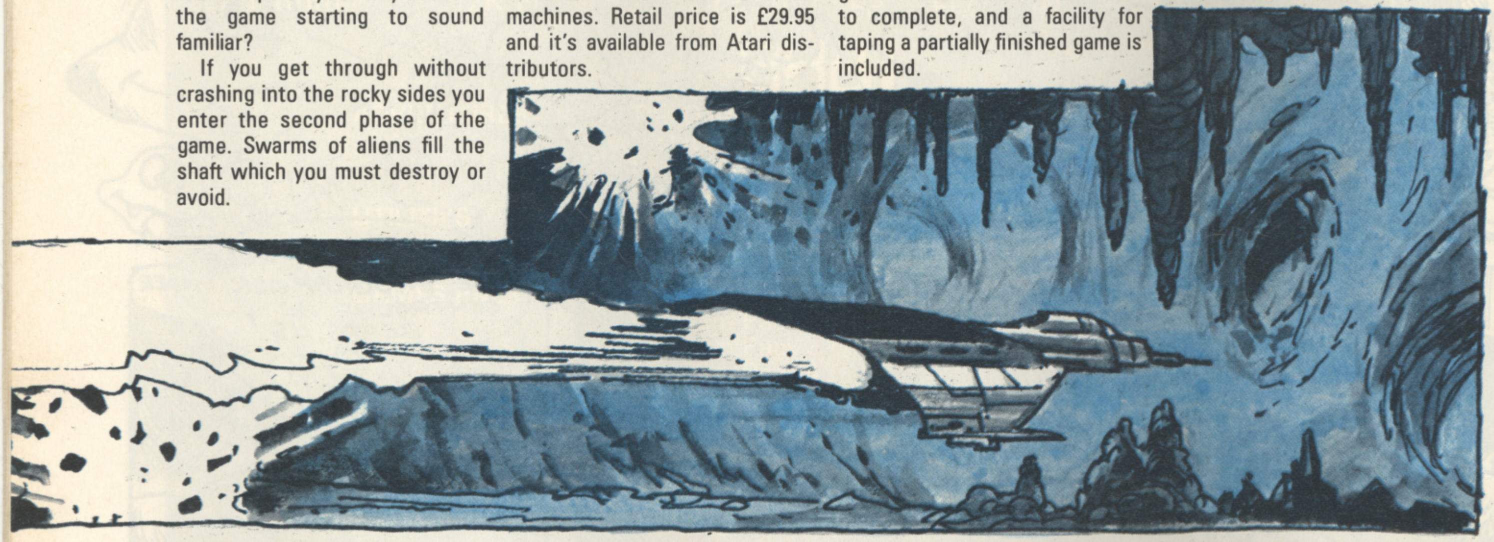
The Seleucid Kingdom was a Greek Empire stretching from north-east Greece to the borders of India — and the prize which the two nations were fighting for was the domination of Greece and the cities on the western coast of Asia Minor.

In this game you relive this ancient battle for power. Improvements have been made to the program logic to make the simulation of warfare more realistic and decisive. A typical game will take about three hours to complete, and a facility for taping a partially finished game is included.

Three maps are provided depicting Greece and the areas of Asia Minor on the Aegean Sea. The forces available to each player include infantry, cavalry, elephants, siege artillery warship and transport vessels.

During the game taxes have to be raised, troops recruited and paid. The program also covers naval encounters, land battles and sieges — and takes account of the various capabilities of different troop types in varying circumstances.

Triumph of Rome runs on a TRS-80 in 16K and comes from Molimerx of Bexhill-on-Sea. It costs £13.51.



FIGHTING THOSE ALIENS . . .

SPACE FIGHTER

Aliens are out to get you and your chances of survival are slim as you fly a space cruiser over undulating terrain dodging enemy fire coming from all directions.

There are five varieties of aliens out to get you and you must avoid being shot down by these nasty characters.

Some move straight towards you, some move down the screen and some diagonally.

Your defence is a laser cannon, and if the going gets really difficult and you feel your ship is in jeopardy of destruction you can activate one of three smart bombs. These immediately blow up all the alien forces on the screen.

The game is similar in concept to the popular arcade game Defender which has frustrated many players. It's written in machine code to speed up the on-screen action.

There are six skill levels and with 10 phases to get through this tough, compulsive game could get you hooked to your Atom monitor.

Space Fighter runs on a 5K Atom with 3K graphics facilities. It comes from Leeds based Atom specialists, Program Power and costs £8.95.

THESE MEAN STREETS

CITY ENCOUNTERS

Big cities may lure you to taste their delights with bright lights but within them hidden dangers lurk.

Stepping away from the traditional setting of Adventure games City Encounters takes place in a concrete jungle. The action takes place in buildings, cellars, garages and down dark alleyways.

The object of the game is to see how you survive in the city. At the beginning of the game each player is allotted various physical attributes including strength, intelligence, and alertness. The computer also gives players with a run-down on their family background, social standing, financial condition.

A special feature of the game is that at any time you can check out where other players are. A description of how the players are getting on is displayed on the screen.

City Encounters is the follow-up to another Adventure, Random Dungeon Generator, produced by Molimerx of Bexhill-on-Sea. It comes in tape form for the Tandy TRS-80 in 16K. The price is £17.10.

GAMES NEWS

GNOME FROM GNOME

HOUSE OF GNOMES

In the House of Gnomes are rooms containing dangers which Superman would be loathe to tackle.

You have to wander round the rooms of the house picking up objects on your way. When you have collected them all without coming to any harm you emerge as the winner, beating the computer.

But hazards abound in the House of Gnomes to prevent you from winning. The gnomes themselves are evil creatures and are waiting to taunt and challenge you. A snap decision is needed to accept the challenge and defend yourself, or to try and bribe them.

This game comes from Bug Byte of Liverpool and runs on the 16K Sinclair ZX-81 It costs £7.

Soon to be released from the same firm are a series of cartridges for the ZX-81 which plug into the machine. They are full K eproms which means that if you only have 1K memory the cartridges will upgrade the memory space giving you a much better game.

Games on the way are Breakout, Pinball, Invaders and a 3D maze game. The cost of these has not yet been decided but is expected to be £13 or £14.

WE'RE UP FOR THE - WORLD - CUP

SOCCER

With the World Cup looming on the horizon football is stepping into the computer games limelight.

Texas Instruments is keeping up to date with its Five-a-Side Soccer cartridge for the TI99/4A computer. It sticks closely to the real game with penalties and fouls. Only one player has possession of the ball at any time but the opposition can tackle and take the ball into play for his own team. He's not always successful and a slip of the joystick could mean you end up a goal under.

To shoot or pass the ball you have to press the fire button. You can speed up the ball by pushing the joystick upwards for a fast ball. There are several variations of the game and it includes the facility to choose the length of the game and play injury time. You have to score as many goals as possible within the time limit.

Graphics in the game are good but the action of the players seems slow. Full sound is incorporated into the game.

Five-a-Side Soccer is available through TI distributors including Currys and Dixons and is priced at £24.95.

WARPED ENTERPRISE

SPACE WARP

Captain James T. Kirk, Mr Spock and the rest of the Enterprise crew are going boldly where no computer game has gone before — into the heart of the BBC microcomputer.

Space Warp, one of the first games on sale for this sought-after computer is based on the popular television series, and one of the oldest computer games, Star Trek.

You have to venture into various sectors of the galaxy, spread before you on a grid. Located within the grid are various space craft, some belonging to unfriendly space warriors and some controlled by allied forces. You can also locate refuelling ships which are vital on your voyage through the stars. And of course the Klingons are there in force, ready to destroy you.

A 16 page booklet accompanies the game tape giving you detailed instructions of how to play.

Bug Byte's Space Warp runs on the Model B machine and you'll need over 16K memory. The game costs £11.50.

The Liverpool firm is making a big push into the BBC market, producing compatible software and has plans to bring out a magazine for BBC micro owners.

ILLUSTRATIONS: JOHN DAVIS

TORTUOUS TUNNELS

ADVENTURE

Wandering through twisting tunnels and underground caverns you can find yourself in all sorts of trouble deep within the circuits of your Atom.

In this game, simply named Adventure, the object is to rescue a beautiful princess from her captors and collect a total of seven treasures on the route.

You will find yourself in a network of caves, a forest, a desert land, and tortuous tunnels during your quest. You wind up in a castle which is filled with evil creatures ready to strike you down given the slightest opportunity.

You must make a snap decision either to go into combat with them, or try and win them over by offering bribes.

Adventure runs on a fully expanded 12K Atom and has taken Program Power about three months to produce because the firm used a special programming routine which allows sentences to be condensed so that you can have a larger vocabulary without needing to store more words in the memory banks. It is priced at £8.95.

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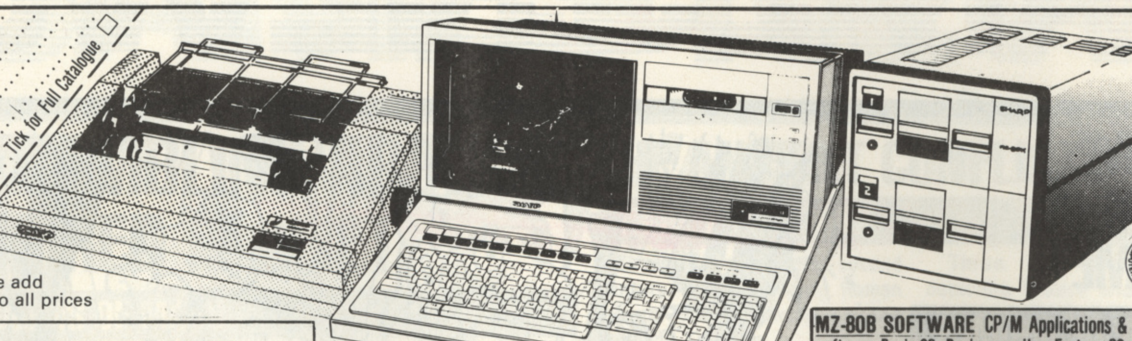

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JUST LIKE THE REAL THING . . .

INVADERS

A new space invaders style game for the Sinclair ZX-81 has overcome some of the limitations which hampered the game in the past.

Written in machine code the on-screen action is very rapid. The firm behind this version, Quicksilva, has tried to emulate the original game as much as possible, even to the extent of introducing a random flying saucer which — if hit — scores mystery points.

The aliens speed increases as their numbers deplete. There are three shields for your firing base to hide behind and a bonus blaster is given after you successfully wipe out five sets of invaders — just like the real thing.

Filling the screen are seven rows of 13 invading aliens, and you can try out your expertise using any of the three skill levels of the game. The lower skill levels of this version seem very slow, but when it reaches the complicated stage the invading hordes move across the screen with alarming speed.

Also incorporated into the game is a facility to store the highest score run up by one player, along with that player's name.

Quicksilva also produce a character and sounds board for use with this game. The graphics are very realistic, particularly the aliens. Sounds add an extra dimension to the game and as you can use the board with other games, it is worthwile investing in one.

You'll need a ZX - 81 with a minimum of 7K RAM to play QS Invaders, which costs £5.50. Excellent value for money!

WATCH OUT — THERE'S A ROBOT ABOUT!

VOYAGER

Stuck in space on a strange space cruiser your job as a cosmic commando is to disable the alien ship and destroy the power generators.

First you must locate the generators which are the ship's power source. You get a three-dimensional picture of the interior of the ship and you are armed with weapons to blow-up the power supply. Only when you have done this is your mission accomplished.

There are bands of security robots that are programmed to detect any foreigner on board the ship.

In addition to 3D graphics the game comes with full sound.

Voyager is supplied by Avalon Hill UK and it is available for a number of different computers. Currently you can buy it in cassette form for £12.95.

It runs on the TRS-80 Colour Computer and standard TRS-80, PET, Apple — both requiring 32K memory — and Atari 400 and 800 with 24K. Disc versions will be on sale for the Apple (48K) and Atari (32K).

CURVED BRICKBATS . . .

BREAKOUT

This version of the popular arcade Breakout game features a curved bat.

The idea is the same as the original game. Your task is to keep a ball in play by bouncing it off your bat. Using the joystick to control the movement of the bat.

At the top of the screen are several layers of coloured bricks which you must dislodge with the ball. For each brick you knock out you are rewarded with a varying number of points, depending on the layer which the brick comes from.

If you miss the ball and don't catch it on your bat it automatically goes out of play. You get three balls to play with. After you have lost the third one the game ends.

Breakout is the latest addition to Bug Byte of Liverpool's range of software for the Vic computer priced £7.00.

ALIEN GUNSLINGERS

CRAZY SHOOT-OUT

Unless you are handy with a six-shooter you'll never escape from the deadly room filled with hoards of alien creatures.

There are two exits from the room but you can only escape when you have shot the aliens lurking in the room.

You move your man around the room picking off the slow-moving creatures. For each one you kill you are rewarded with a number of points. When all the aliens turn green you know there are only 10 left to get rid of.

You can angle your shots left or right, up or down. If you need to you can take diagonal aim at the creatures.

The first wave of beasts is the easiest. After wiping them out, you make your man run out of one of the exists — taking care not to bump into any of the deadly radioactive walls.

Then you begin the second phase, and things get tougher. The aliens shoot back at you and increase in number. Each stage gets more difficult as the aliens fire back at you with increasing rapidity.

Crazy Shoot-Out comes from the newly formed Mapsoft subsidiary of Southend based Maplin Electronics. This maddeningly addictive game costs £29.95. It runs on the Atari 400 or 800 personal computer and is an American non-Atari imported cartridge.

WHERE THINGS GO BUMP IN THE NIGHT...

Things tend to go bump in the night when you are venturing into a haunted house via your Atari Video Computer System.

Haunted House is the latest game brought out by Atari and it marks a change of tack for the firm. Until now there has only been a limited adventure game for the VCS as Atari concentrated its expertise on arcade games.

An adventure game already exists in the range based on the classic Dungeons and Dragons game. But it all takes place visually rather than in the written form used by computers with more memory space than the VCS.

In this game you control a man who walks through the house which is in complete darkness.

HAUNTED HOUSE

The house is riddled with ghosts and ghoulies which you have to avoid or destroy. Which ever is easiest for your own safety.

You ask simple questions which the computer answers by moving you graphically on the screen. Objects which you discover also appear and can help you in your travels. Usually you can keep useful things which could help you out of trouble, like a length of rope or a weapon. You can also acquire some money or other valuables which can be used for bribing any hostile characters you come across.

In Adventure games you only have one life to play with, unlike arcade games when you are given more. So you have to be extra careful when moving into various rooms.

A good plan to follow is to draw a map as you investigate the house, and describing what you found in different rooms. This is a help when you move to a different location because you can look back and ensure you don't go to the same place twice or make the same mistakes more than once.

Haunted House is available through Atari's UK distributors and it costs £29.95.

FANCY A BITE?

Pacman seems to be the hero of the video screens this year with many of the maze games on the market.

The latest games centre to be afflicted is the G7000. Philips has named its version Munchkin because of the small blob with the big mouth who whizzes around the screen devouring anything in his path.

With Munchkin on the screen are three Munchers — which pursue the Munchkin — and 12 Munchies. Each Munchie is worth either one point, or three points if he is flashing when Munchkin eats him.

MUNCHKIN

Using the handset controls you move Munchkin around the paths of a maze. If your Munchkin swallows a Muncher he earns five points for the first one. For the second you score 10 points, and 20 are up for grabs for a third.

The Munchers are only vulnerable when the Munchies are flashing different colours.

All three Munchers have an in-built secret weapon which allows them to recharge their energy. In the centre of the maze is a rotating chamber which they use as their headquarters.

When one of the Munchers is gobbled up by Munchkin it transforms into a ghost. In ghost form the deceased Muncher heads for its base and a few seconds later he reappears hungry for more action.

The game gets more difficult as it progresses. Once your Munchkin has got rid of the 12 Munchies the maze momentarily clears of its inhabitants. Then another batch of them materialise on the screen for your Munchkin to continue eating. With each new wave the Munchies speed up making it harder for you to catch them.

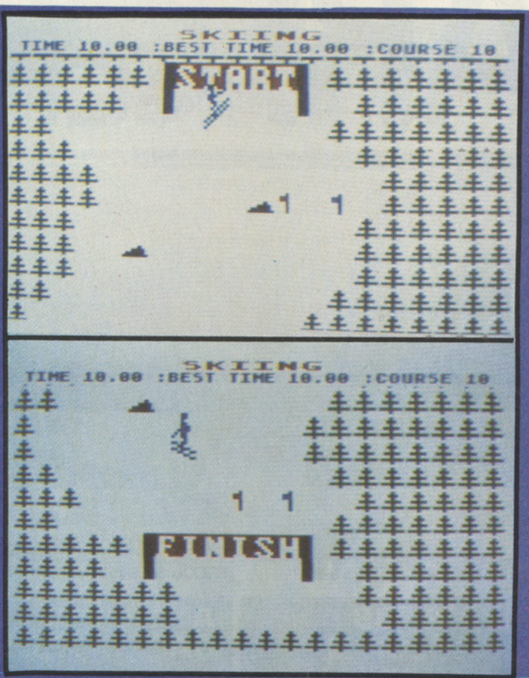
There is a facility to record the current and the highest score.

There are four different standard mazes to play in, plus another four mazes whose walls disappear when Munchkin is moving. If Munchkin bumps blindly into a wall the maze flashes on the screen for a few seconds for him to get his bearing.

You can also make up your own mazes by deleting or adding lines to the standard mazes.

Munchkin is available from G7000 stockists and costs about £20.

BEHIND THE SCREENS


SKIING
TIME 10.00 :BEST TIME 10.00 :COURSE 10
START
SKIING
TIME 10.00 :BEST TIME 10.00 :COURSE 10
FINISH

When you relentlessly hammer your video centre to death take a breather to ponder over who brought it to life with video games.

Before you plug a video game into a console unit it has been through up to six months nurturing by a team of designers and programmers.

Video games emerge in their final form after several stages and *Computer and Video Games* talked to expert games designer Chris Horseman of Wembley based Centaursoft to find out what those steps are.

Often it is the games designers themselves who think of the original idea for a game, but he is always willing to listen to and develop ideas other people come up with.

An idea for a game as innovative as Space Invaders is rarely discovered but ideas are always being tossed around in the design room. Chris Horseman, who worked on the Atari games produced by Thorn-EMI, gets his ideas from watching television, existing arcade games which serve as inspiration, and taking a theme and developing it.

He will pick up a subject, often to do with sport, and develop it. For instance the Atari game Jumbo Jet Landing was the result of that method.

The recent invasion of video games based on space encounters is becoming repetitive and sometimes dull. That is why designers are trying to get away from that theme. "I'm working on little animals at the moment," Chris said, "and am trying to think of good games based around them." Judging by the popularity of recent arcade game Frogger and Centipede he is on the right track for a winning formula.

The essence of a good video game lies in two sections. It must be visually attractive, which doesn't mean the screen has to be cluttered with graphics that serve no purpose. It means the graphics should be interesting and the screen colourful. And perhaps more importantly there must be an element of human engineering. "That means there must be something in a game that you don't always see," he explained.

Remember the flying saucer which flies across the screen at random intervals during Space Invaders? That's an example of human engineering. Because you never know when it will appear, and because it represents a high points score, the hidden element makes the game more compulsive.

Then the designer must decide exactly what the game will consist of keeping within the realms of programming feasibility.

Drawing doodles may be an idle pastime for you but to Chris it is a crucial job. "Even though I sometimes do them on the train they are a very important stage in making a video game."

He roughly draws a square box representing the screen and fills it with a game idea. Currently working on a ski-ing game he had drawn on the screen the slopes and different landscape possibilities, the skiers positioning in relation to programming, and the graphics which have to be used.

Once he has arrived at what looks like a viable game the designer takes the proposals to the marketing experts. "The real headache is marketing," moaned Horseman. "The marketing people aren't enough in tune with the market. If they are they will probably react to a game in the same way as the consumer."

The decision to carry a game's idea through to production lies with the marketing chiefs so it is imperative that the designer can show them a clear picture of that game.

From there it goes into the hands of the programmer. Now it is up to him to translate the game to the screen. Usually he spends about three months solidly programming, six months if the game is an exceptionally complex one.

It is often inevitable that a game will change during the programming stage, as the programmer can spot little additions to improve the game as it appears on the screen.

"Some change quite a bit from the original concept, but it depends on a programmer's creativity." A good games programmer should have a creative mind and the ability to see what can improve a game, or what detracts from the game.

According to Chris, finished Atari games are exactly the same as the original design. This is because Atari works on a system of very strict documentation which the programmer uses like a manual.

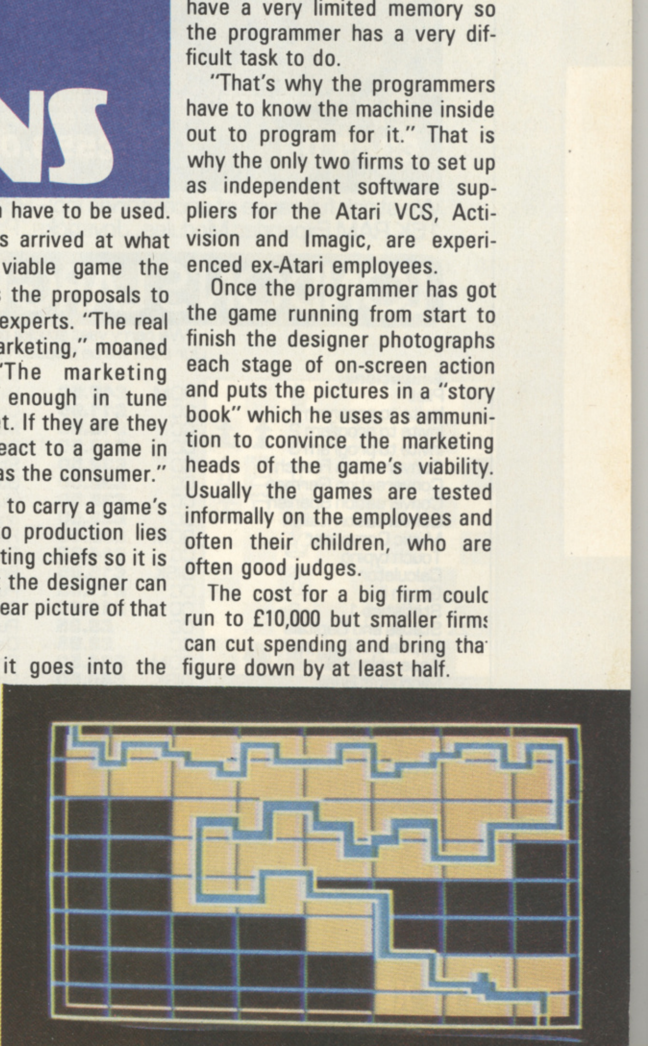
"It's a very strict system with notes that the programmer must stick to at every stage. He must also keep to the time scale laid down in the documentation."

Problems in programming video games centres lie in the lack of memory capacity. "They have a very limited memory so the programmer has a very difficult task to do.

"That's why the programmers have to know the machine inside out to program for it." That is why the only two firms to set up as independent software suppliers for the Atari VCS, Activision and Imagic, are experienced ex-Atari employees.

Once the programmer has got the game running from start to finish the designer photographs each stage of on-screen action and puts the pictures in a "story book" which he uses as ammunition to convince the marketing heads of the game's viability. Usually the games are tested informally on the employees and often their children, who are often good judges.

The cost for a big firm coul run to £10,000 but smaller firm can cut spending and bring tha figure down by at least half.



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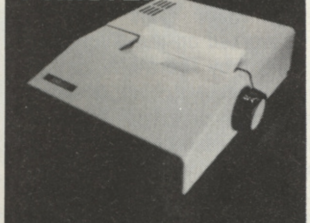

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CHESS

Everyone knows computers can play chess — but they are also very able problem solvers.

An intriguing type of problem on which little work has been carried out so far is the *retrograde analysis* problem. These problems, unlike conventional ones — with requirements such as "White to play and mate in three moves" — are concerned only with the past history of positions.

A recent collection of retrograde analysis problems by the American logician Raymond Smullyan was presented as a series of chess detective stories, entitled *The Chess Mysteries of Sherlock Holmes.*

Here is a — relatively simple — example invented by Smullyan.

It is Black's move. The White King has accidentally fallen off the board. The problem is to place it back on the correct square.

At first glance, this problem seems unsolvable, or rather, there seems no reason why the King cannot be on any one of many possible squares. The key to the solution is to notice that the Black King is in check.

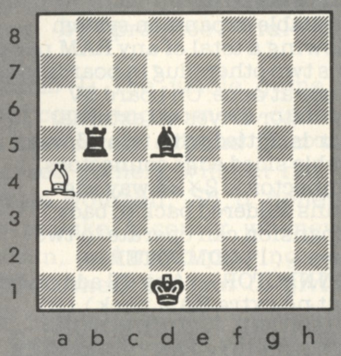

FIG 1

Since White moved last, what move did he make to give check? If the White King were on h3, say, it is impossible to "unmake" any previous White move which takes Black out of check.

This is an example of what is known as an *imaginary check*. Since the initial position is known to be legal, the only possibility is that White has just moved his King away from b3 — to a3 for example, but not a2 where it would itself be in check — discovering check by the Bishop on a4.

Unfortunately on b3 the White King is in double check by the Black Rook and Bishop. What was Black's previous move?

There is no possible Rook or Bishop move by Black which produces the required double check configuration, apparently another example of an imaginary check. In fact, however, this one is only "pseudo imaginary" since the desired effect can be achieved by an *en passant* Pawn capture. Figure two shows the position shortly before.

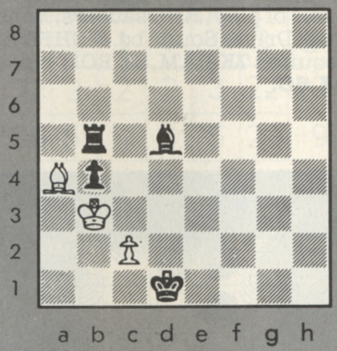

FIG 2

Black has just moved his Bishop to give check. The game continues 1. c2-c4, b4 x c3 *en passant*; 2. Kb3 x c3, giving figure one. Thus, the White King originally stood on c3.

This example illustrates a number of important features of retrograde analysis problems.

Firstly, the phrasing of the question does not immediately suggest that any backward analysis of the position is necessary, but the problem cannot, in fact, be solved otherwise.

Secondly, it is crucially important to think of asking the right questions.

Care must be taken with imaginary checks; a move may have involved a capture — including an *en passant* capture; a piece on the eighth rank may represent a promoted Pawn.

It is important to note that retrograde analysis problems are generally not concerned with strong sequences of play, or even sensible ones, but merely legal ones. Underpromoting, that is turning an eighth rank pawn into something other than a queen, is quite legal (even likely) in these problems.

A researcher at Bristol, Brian Alden, has recently written a program which solves quite a number of retrograde analysis problems and later I will look at this in some detail.

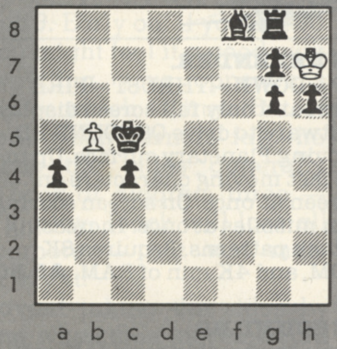

FIG 3

In the meantime here are two more problems for you to consider. The problem given in figure three is quite simple. To program the solution to this and the previous one you have to write a reverse legal move generator.

The rightmost Pawn in figure four is not a printing error. It is deliberately placed halfway between the g file and the h file.

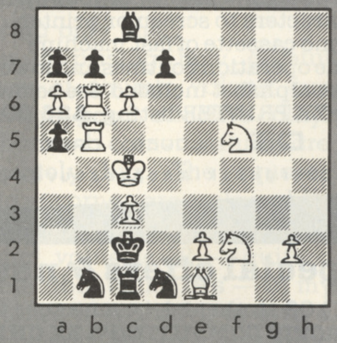

FIG 4

The problem here is: does the Pawn stand on g2 or h2? It is White to move and as a cryptic hint, you are given that there have been no "underpromotions". Brian Alden's program solves this problem — can you do as well? Solution next month.

By Max Bramer

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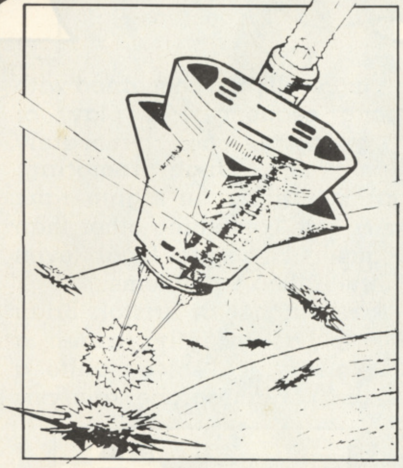

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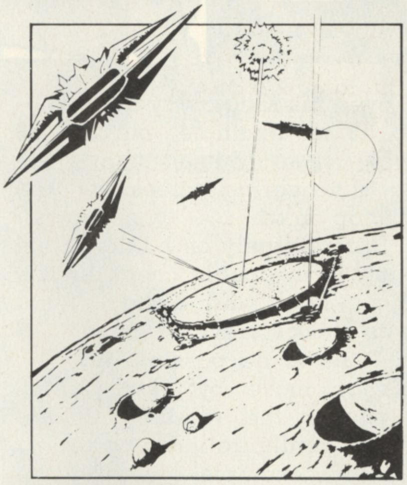

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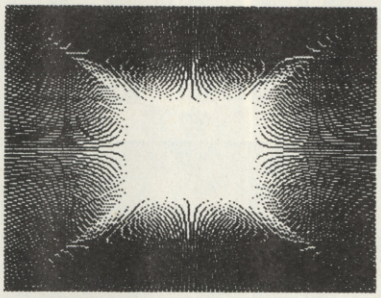

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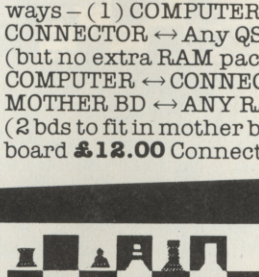

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REVERSI

BY JOHN BALL

The Reversi column has been taken over by John Ball this month. John is a co-author of the book, *The Key to Othello* and a regular U.K. Othello finalist. He has also written a Reversi program for the Sharp MZ-80K, available from Sharpsoft. We will continue to look at computerising Reversi every three months.

STAYING SHARP . . .

Making your computer play well can — as a bonus — make you think more clearly too.

Somehow, you need to give it a sense of judgement as good as your own, to make it play a nerve-wracking tussle against you. Ideally a program should be able to beat you as often as you beat it. But as a human, you improve with practice, whereas the computer cannot, unless you update it with improved logic. You can do this if you have written it yourself.

That is what I have been doing in great depth on a Sharp MZ-80K, to provide me with a reasonable opponent. As a top British player, available programs were no good to me. Ideally I wanted one up to my standard — and repeated updates improved my game too!

This article is intended to help both you and your computer play Reversi — also known as Othello — more skillfully, by three simple rules-of-thumb. They form the backbone of my program, and have been balanced by practice trial-and-error.

Thumb 1: The whole game is about capturing corners, as then you can safely expand from the captured corners without risk of capture yourself, So a general rule is take a corner whenever you can, and *avoid* playing next to the corners for fear of giving your opponent a chance to take it. Generally, the nearer you play to a corner the more dangerous it is in the long-term. So set values as in diagram one, making the machine select the most negative valid move.

Thumb 2: You want to force your opponent to give you one or more corners as early in the game as possible. So you want to force him by giving him no option. The best way to reduce your opponent's options is by taking as few pieces as possible — but don't lose them all! With that ploy, you can easily slaughter any thumbless human or machine. Once you have the corners secure, you then get revenge.

8	-9	29	5	4	4	5	29	-9
7	29	22	3	2	2	3	22	29
6	5	3	1	1	1	1	3	5
5	4	2	1	○	●	1	2	4
4	4	2	1	●	○	1	2	4
3	5	3	1	1	1	1	3	5
2	29	22	3	2	2	3	22	29
1	-9	29	5	4	4	5	29	-9
	a	b	c	d	e	f	g	h

Fig. 1

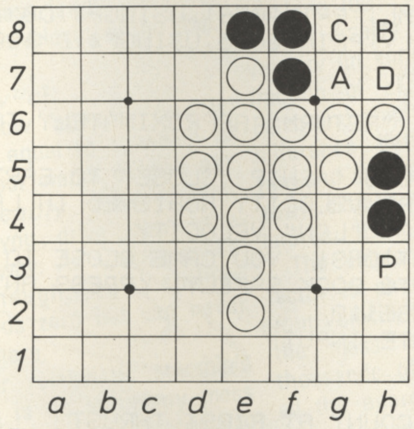


Fig. 2

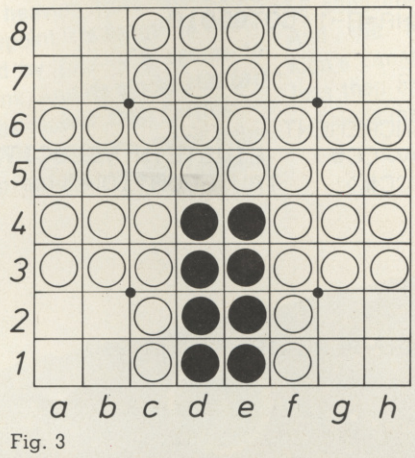


Fig. 3

In diagram two, the square that captures least pieces for Black — D at h7 — forces White to give a corner by playing at A or C — it is the best move. So any move that takes lots of pieces early on must be bad. Add points to the value of such squares to dissuade the computer playing there.

Thumb 3: Early on, if you take a side you might feel it a good way of restricting your opponent's options — which is true. But at the end, when corners fall, he who has the sides generally loses. Look at diagram three — Black to play. Black will lose all four corners — but win massively. Try it!

So avoid taking the sides by spotting when side pieces would get captured, and again make such squares less attractive.

Balancing thumbs: No single thumb should totally over-ride any other. Sometimes it is better to take lots of pieces — if it avoids giving away a corner. Capturing a side isn't all that disastrous — so in diagram two, if it is White to play then P at h3 is far more preferable to A or C in the corner. So only add a few points to the side capture value. It also takes two pieces — but is better than the alternatives of capturing only one.

It is surprising how careful balance of thumb values can encourage good effective play. My Thumb 1 corner values are deliberately big. The squares next to a corner are ugly, while the corner is a luscious −9! The diagonal value is 22 — quite a bit preferable to the 29's — in my experience if you have to give a corner away, do it diagonally. Nine times out of 10 it is best.

Of course, there are times when the thumbs are not valid — at the end you want to capture as many pieces as possible.

```
10 ' RELATIVISTIC STARSHIP SIMULATOR
20 ' COPYRIGHT (C) DAVID LANGFORD 1982
30 '
100 ' SET UP VARIABLES
110 CLS
120 DT=0:DELT=604800 ' TIMESTEP: 1 WEEK (SECS)
130 T0=0:T=T0 ' EARTHTIME & SHIPTIME (SECS)
140 V#=0D0 ' VELOCITY (METRES/SEC)
150 A=0:G=9.80665 ' ACCELERATION 1 GRAVITY (M/SEC/SEC)
160 AMAX=10 ' MAXIMUM THRUST 10G
170 D0=0 ' DISTANCE FROM EARTH
180 SY=31557600 ' SECS/YEAR CONVERSION
190 ML=9.4605E15 ' METRES/LIGHTYEAR
200 C#=2.997925D8:CC#=C#*C# ' VELOCITY OF LIGHT
210 TAU=1:MAS=1 ' RELATIVISTIC CORRECTION FACTORS
220 VDOK=DELT:DDOK=DELT*DELT*10 ' MINIMUM V & D FOR RETURN
1000 ' SET UP DISPLAY
1010 F$="##.####[[[[ ":G$="##.################"
1020 S$=STRING$(9,143)
1030 PRINTS$"   STARSHIP 'FANGLORD' INSTRUMENT READOUTS    ";S$
1040 PRINT@128,"VELOCITY";TAB(36)"METRES/SEC";TAB(50)"TIMESTEP"
1050 PRINT"V/C (TO 16 PLACES)";TAB(49):PRINTUSINGF$+"YR";DELT/SY
1060 PRINT"ACCELERATION";TAB(25)"0";TAB(36);"GRAVITIES"
1070 PRINT"EARTH TIME";TAB(36);"YEARS";TAB(50)"TIME LAG"
1080 PRINT"SHIP TIME";TAB(36);"YEARS";TAB(61)"YR"
1090 PRINT
1100 PRINT"DISTANCE FROM EARTH";TAB(36);"LIGHTYEARS";TAB(61);"KM"
1110 PRINT"APPARENT DISTANCE";TAB(36);"LIGHTYEARS";TAB(61)"KM"
1120 PRINT
1130 PRINT"'TAU' FACTOR"
1140 PRINT"SHIP MASS INCREASE";TAB(43);"(AS SEEN FROM EARTH)"
1150 PRINT
1160 PRINT"TO INCREASE/DECREASE/HALT ACCELERATION, PRESS +/-/0 KEYS"
2000 ' DISPLAY/MODIFY FIGURES
2010 PRINT@152,USINGF$;V#;:PRINT@216,USINGG$;R#;
2020 PRINT@344,USINGF$;T0/SY;
2030 PRINT@408,USINGF$;T/SY;:PRINT@433,USINGF$;(T0-T)/SY;
2040 PRINT@536,USINGF$;D0/ML;:PRINT@561,USINGF$;D0/1000;
2050 PRINT@600,USINGF$;D/ML;:PRINT@625,USINGF$;D/1000;
2060 PRINT@728,TAU"     ";
2070 PRINT@792,MAS"     ";
3000 ' TEST FOR SUCCESSFUL "RETURN" APPROXIMATELY TO EARTH
3010 IFT0<10*DELTTHEN4000
3020 IF(ABS(D0)>DDOK)THEN4000 ' SHIP "CLOSE" TO EARTH
3030 IFVFLAG=1THEN3050' ZERO VELOCITY ACHIEVED IN LAST DT
3040 IFABS(V#)>VDOKTHEN4000' "LOW" VELOCITY
3050 PRINT@896,"CONGRATULATIONS!  YOU CAME CLOSE TO EARTH AGAIN, WITH LOW ";
3060 PRINT"ENOUGHVELOCITY TO DOCK SAFELY. <PRESS ANY KEY TO RESTART>";
3070 IFINKEY$=""THEN3070ELSE110
4000 ' ACCELERATE/DECELERATE INPUT
4010 A$=INKEY$
4020 IFA$=""THEN5020
4030 DT=DELT ' START TIME COUNT AT FIRST THRUST
4040 IFA$="+"ANDA<AMAXTHENA=A+1:GOTO5010
4050 IFA$="-"ANDA>-AMAXTHENA=A-1:GOTO5010
4060 IFA$="0"THENA=0
5000 ' CALCULATE NEW VALUES
5010 PRINT@280,A;
5020 DV=A*G*DT 'VELOCITY INCREMENT
5030 V2#=(V#+DV)/(1D0+V#*DV/CC#) ' EINSTEIN VELOCITY ADDITION
5040 TTAU=SQR(1D0-V2#*V2#/CC#)  ' TAU EQUATION
5050 T0=T0+DT
5060 T=T+(TTAU+TAU)*DT/2
5070 D0=D0+(V#+V2#)*DT/2
5080 TAU=TTAU
5090 MAS=1/TAU
5100 IFSGN(V#)<>SGN(V2#)THENVFLAG=1ELSEVFLAG=0
5110 V#=V2#
5120 D=D0*TAU
5130 R#=V#/C#
5140 GOTO2010
```

Illustration: Terry Rogers

EINSTEIN-A-GO-GO

If you want a realistic space game, why not write Einstein's theory of relativity into your program?

In science fiction there are as many ways of commuting to the stars as there are authors. The first method is to let your spaceships travel as fast as you like — as in E.E. Smith's cosmically ridiculous space operas.

Unfortunately it seems that faster-than-light travel is forbidden by cosmic law, even more so than cheap Tube fares. The second method is to take a short cut through something called hyperspace — as in almost any Isaac Asimov book. This is simply FTL travel in a clever plastic disguise, and it falls victim to the same problems. The third method is to grit your teeth and accept that old tyrant Einstein's speed limit.

The velocity of light c is the highest speed possible in our universe — about 300,000 kilometres per second. To travel across the galaxy at this speed would seemingly take 10,000 years or so, causing spacemen great technical problems at journey's end — such as being dead.

But relativity has its advantages. On a relativistic ship — one that travels close to the speed of light — mass, length and time are strangely distorted. We can't accelerate all the way to *c* because at that point the ship's mass reaches infinity. It becomes infinitely hard to push.

Also, as *c* approaches, the ship's clocks run slower than those at home. This features in hordes of "realistic" SF novels like Robert Heinlein's *Time for the Stars*, where the hero has his personal clock slowed by relativistic travel and returns to find himself barely older than his great-grandniece.

Tau Zero by Poul Anderson is another famous example. Time aboard Anderson's starship eventually flows so slowly that the ship outlives the universe itself. The *tau* of the title is the correction factor for mass, length and time: if *v* is the velocity of the ship, *tau* is

$\sqrt{1 - v^2/c^2}$.

At low speeds *tau* is almost equal to 1, which is why your watch doesn't get *noticeably* slower each time you drive down the motorway. As *v* approaches *c*, though, *tau* shrinks towards zero but can never get there.

Our relativistic starship's mass is its stationary mass divided by *tau* — it seems to get heavier from the Earth viewpoint. Its length is multiplied by *tau* — it seems to shrink. And its clocks run *tau* times slower than Earth's.

We need one more equation before writing relativity into a starship program — Einstein's equation for adding velocities.

Normally, if you're travelling at velocity *v* and accelerate to add an extra bit — call it *u* — to your speed, you expect the resulting speed to be $u + v$. This works fine at speeds much less than *c* . . . but the correct, answer is.

$u + v$

$1 + uv/c^2$

Here's a crude TRS-80 program using these equations and some very lumpy approximation — see lines 5020-70 — to track an imaginary starship. You can give the good ship *Fanglord* various accelerations towards or away from Earth, from a normal one gravity (1G) to a crushing 10G.

The display shows your velocity (in km/sec and as a fraction of *c*), acceleration, Earth and ship time (and the difference between these), real and apparent (shrunk by *tau*) distances from Earth, and *tau* itself.

The ship's mass increase factor is shown too. When your velocity is almost *c* and the mass is hundreds or thousands of times greater, all the energy of this mass ($E = mc^2$) would have had to be supplied by burning fuel. And the Hiroshima explosion's energy represented less than one gram of mass!

This is mainly a demonstration of "relativistic computing" from which you can steal bits for you own space programs. But there are challenges to try.

How quickly can you make the round trip to Proxima Centauri — 4.3 light years away — and back? Can you use the time-slowing to lose a year, say, arriving home in minimum time with that TIME LAG readout showing approximately one year?

Can you return to Earth without either overshooting hopelessly or reaching retirement age?

The "target" distance and velocity for return are set in line 220 and can easily be increased.

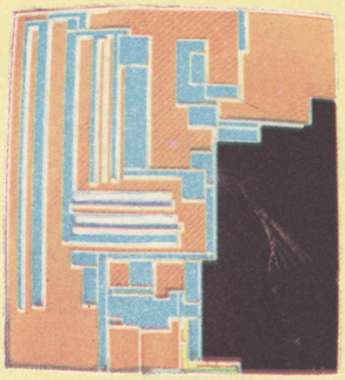
As well as blowing people's minds, relativistic calculations can boggle home computers. Even using double-precision for *v* and *c*, the program goes ga-ga if you accelerate indefinitely — when the machine can no longer make *v* any closer to *c*, acceleration effectively halts. "Captain," says Spock, "some unknown forces has disabled the warp drive . . ."

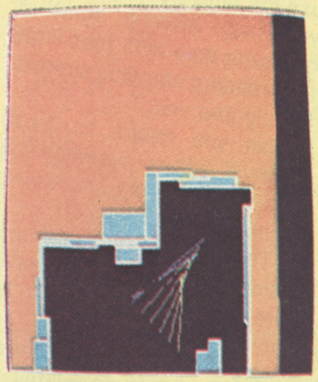
Footnote to program: The left-bracket signs in line 1010 should of course be uparrows ( ). Reducing DELT in line 120 makes the program slower.

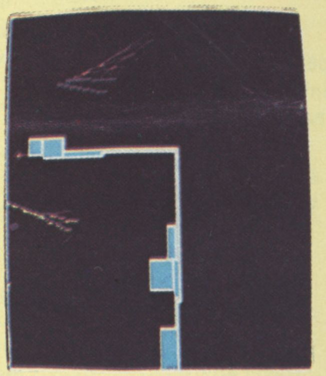
BY DAVID LANGFORD

DRAW YOUR OWN CONCLUSIONS

TIPS ON QIX







The arcade industry is already convinced that Qix is going to be a big draw.

Most arcade players are still making their minds up about the game which has no theme but the industry feels Qix is pointing the way to the video games future.

Tactically the game is still an enigma as players develop their own styles and even set their own game targets — like drawing pictures or putting their own initials on the screen.

We have decided to give tips to gain a really big score on one screen.

Space capture is the name of the game as your drawing head ventures off the relative safety of the existing lines and into the realm of the Qix, a large spark which must be avoided. Additional problems are the Sparx which travel along the border of the screen and up the lines you have drawn and the Fuse which chases you along an unfinished line if you hesitate in space.

Double score is awarded for drawing in "slow mode" which fills the boxed area in with a red rather than blue colour. Observant Qix players will already have noticed that you can score 1,000 bonuses for every percent of the screen filled in, over the 75% you need to earn a new screen.

The third way to score highly is to split the Qix into two. This is done on the third screen when two Qix whirl around.

The way to achieve all these ideals is to start the game by drawing thin blue boxes off the bottom of the screen. Two of these set a few inches apart can be added to by a third thin blue box which runs from the top of one vertical and falls just short of the other. This is your first trap and you hope that the Qix will be tempted inside it, leaving you with the simple task of switching to slow mode and running across the gap to fill the rest of the screen in red. Make sure you do go right across as the Qix can escape through any gap.

Usually the Qix will remain out of reach and as the Sparx continue their hectic dash around your lines you will be forced to keep on the move.

Keep adding to a network of thin blue boxes and give yourself more traps to tempt the Qix into. Long vertical chambers provide optimistic — but high-scoring chance of success.

Always keep an eye on the timer — which will release faster Sparx to chase you — and the percentage of screen filled — you don't want to go over 75% until you are ready.

You won't get a long time on Qix but you will get a challenge . . . 99% has been done!

RECORD BREAKERS

How do you rate in the arcade world. On the right we tell how four students set a new Asteroids world record, but how close are you on your favourite machine to being a world beater?

Here are some of the highest scores we have come across on some of the most popular machines around. If you can better them, or have a top score on some other machine (what about Donkey Kong?) we would like to hear from you.

Scramble	626,130	Michael Holdron
Gorf	228,570	John Lee
Phoenix	252,910	Richard Ruddick
Battlezone	157,000	Joseph Andrews
Moon Cresta	126,950	Andrew Davies
Packman	281,260	Stephen Mainwaring
Galaxians	431,820	Stewart Mathers
Missile Command	2,480,000	Kyle White

KENT QUARTET TOP 100 MILLION

Four students from Kent University have blasted their way into the arcade game record books by topping the 100 million mark on Asteroids.

David Birkett, David Hill, Tony Thomas and Alan Tilling took on their university's Asteroids machine in shifts to achieve the score.

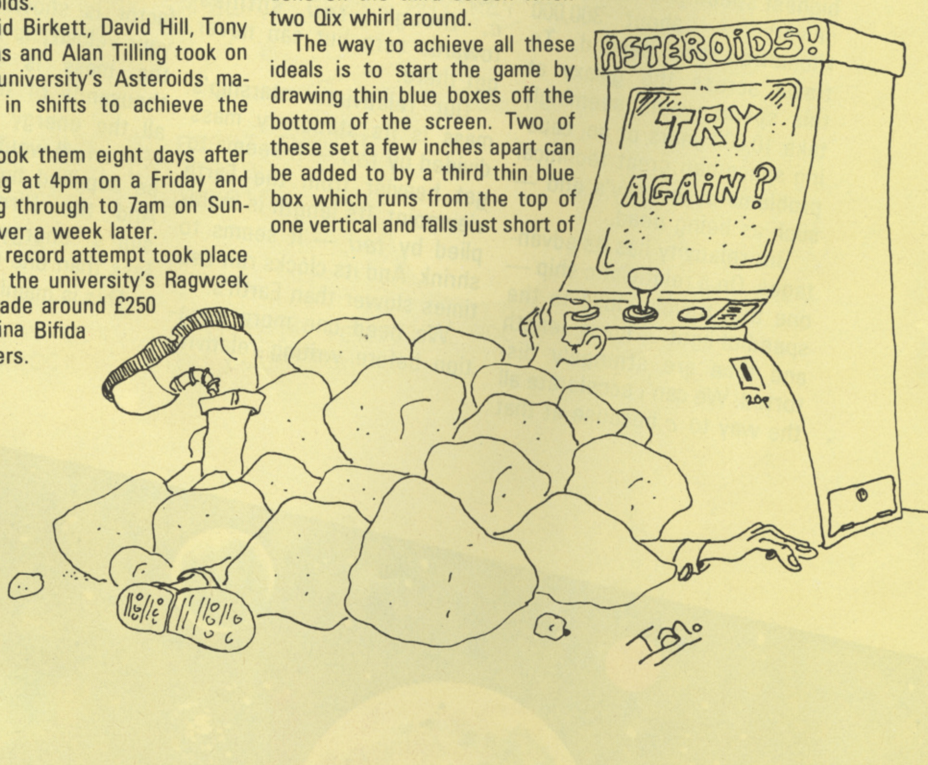
It took them eight days after starting at 4pm on a Friday and playing through to 7am on Sunday, over a week later.

The record attempt took place during the university's Ragweek and made around £250 for Spina Bifida sufferers.

ARCADE FUN

Humour is a very personal thing and in every batch of cartoons sent to a magazine there are a few which will appeal to someone.

Ian Bennett sent in an arcade series of cartoons which appealed to us and we will be presenting our favourites on these pages over the next few issues.


ASTEROIDS!
TRY AGAIN?
20p
Ian

ACTION

ALPINE SKI

IT'S NOT ALL DOWNHILL ON THE SLOPES

St Moritz is only as far away as your local arcade with the new game of Alpine Ski.

The game offers three winter Olympic disciplines, downhill slalom and ski-jump.

The first frame is the downhill with obstacles to be dodged. These include, trees, other skiers and even a snowplough. To help you avoid these hazards, there is a good left-right control and an accelerate or push button which simulates the skier pushing off.

It needs careful timing to judge a swerve around a tree. Other features of the course include, iced up lakes which score a bonus but shoot you across fast, and increase your speed.

The second frame features the slalom with gates made up of flags for the skier to pass between. Each hit flag knocks 100 points off your score, while 50 to 300 points are notched up for each one successfully negotiated.

Finally the skier is faced with a ski-jump. Judge your take-off carefully as plenty of points will be scored for a long jump.

And a good score here could make sure of a bonus time. The skier must wait until he has enough speed before taking off.

The basic game lasts $1\frac{1}{2}$ to $2\frac{1}{2}$ minutes, depending on the operator, but bonus time is awarded for a high score of either 5, 10 or 15,000 points and for each 10-15,000 points after that.

But as the course gets more difficult, time bonuses are more difficult to win.

Fast reactions are needed to dodge obstacles and align the skier with the next slalom gate and the game rewards the player who can think and look beyond the immediate target to prepare himself for the following one.

PINBALL

Pinballs are already talkies, now they have taken the plunge into the film world.

The latest offering on the pinball scene, features slide shows which are won by the player if he hits targets in the correct sequence.

The film machines come in two varieties. The Sexy Girl series features nine different slide shows of girls stripping off. The film is projected onto a 9" square screen in the centre of the playfield. There are 36 different slides and according to Keith Frankham of distributors Rega, only accomplished players will see all 36.

"The girl finishes up in a 'page 3' pose," said Frankham.

The Magic Picture Pin series is a different playfield and features films of more general themes, like: space pictures, boats and animals. There are seven in this series.

"These games have only just been released in this country," said Frankham, "So it is too early to say how they are going but they have proved very successful in Germany and are played for a much longer period than other pinball machines."

DRIBBLING

THAT OLD WORLD CUP FEVER

The arcades are going to cash-in on the World Cup fever this summer with a new table-top soccer game.

The thirst for soccer will be sated by Dribbler — an electronic version of the old Bar Football craze.

The new football game has several advantages over its predecessor, for example, it allows the players to choose their team colours from six different strips.

This game originated in football-crazy Italy and on a perfect green pitch, which would even send Q.P.R. fans into raptures, two teams of seven-a-side battle it out over 90 minutes — compressed into two minutes for excitments sake.

Two levers, on each side of the table, take the place of the four handles which used to act as controls on the manual version.

The left-hand-side lever controls three forwards and the right-hand-side three defenders and a goalkeeper.

The players can be moved back-and-forth across the pitch but they can also dribble the ball forwards. A fire button enables the player in possession to shoot or pass and if he hangs onto the ball too long (over three seconds) this will happen automatically.

The defending player can move his men into tackling positions and hope to deflect the ball away or send his keeper diving across the goalmouth to push a shot away.

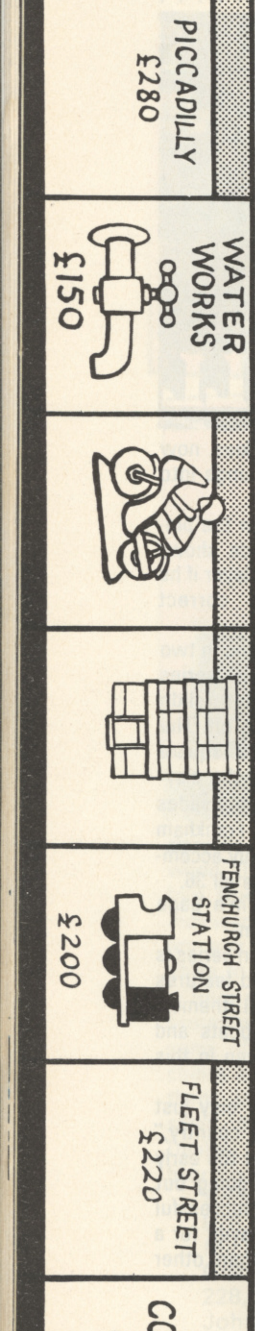
Throw-ins are avoided but it is possible to win a corner. These are thumped across the goalmouth by the machine itself with both defenders and attackers hoping to make decisive contact.

The referee's whistle keeps the game flowing and the time left and present score is displayed on both sides of the machine.

Scando Games, which is distributing the game over here, is planning to organise leagues and other championships through the pubs and arcade sites.

Ian Jamieson of Scando claims that Dribbling championships have already proved successful in Italy with World Cup tickets being put up for prizes. And one final plus: the crowd in the Dribbling stadium never cause any trouble!

GO TO JAIL
OXFORD STREET
£300
CHANCE
LIVERPOOL STREET STATION
£200


PICCADILLY
£280
WATER WORKS
£150
FENCHURCH STREET STATION
£200
FLEET STREET
£220
COMMUNITY CHEST

Ever fancied being a property speculator and making millions? Well, with the help of your Sharp you can get a taste of real life wheeler-dealing in this adaptation of the famous board game Monopoly.

From two-to-five people can play the game and £6,000 is divided equally among the players. The winner is the one who survives bankruptcy for longest or accumulates a nest egg of £5,000 in his bank account.

Moves are determined by a random selection of numbers from 1-to-5 which are printed up on the screen and the player must try to stop the small arrow which loops above these over the number of his choice. This is an interesting idea which allows some skill into the final result as there is usually at least one number you can avoid if you are sufficiently dexterous.

mino

The aim is to buy property for twice its rental value and then increase the rent by pouring in more money on subsequent landings.

Just like the board game rents have to be paid to opposing players if you land on their property.

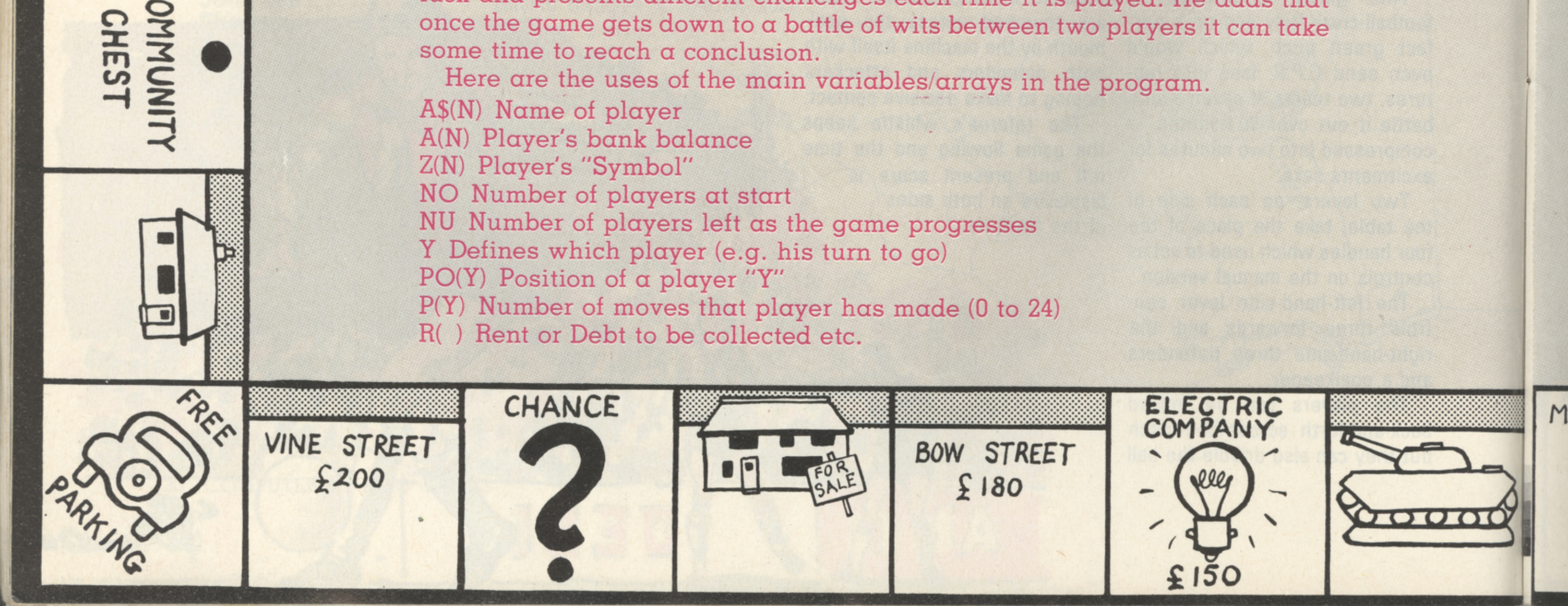
A current bank balance is displayed at the top of the screen at the start of each player's turn — so you know just how much cash you have left to splash out on desirable residences.

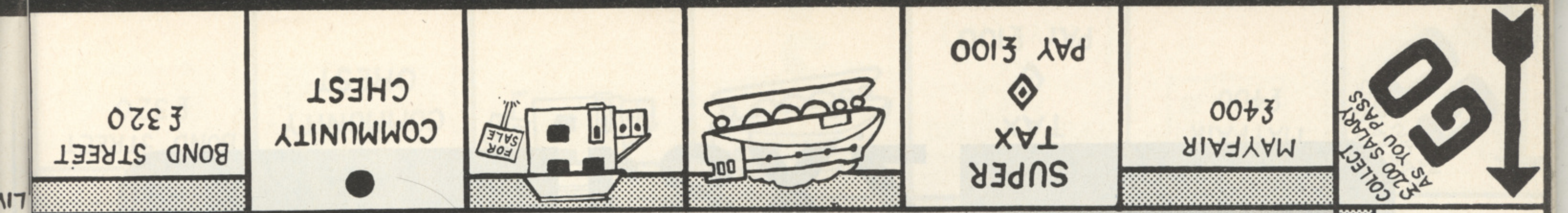
If you get into financial difficulties you may sell property for one and a half times its original value by pressing the (S) key. But if you have no property to sell you face bankruptcy.

The author says the idea for the game came about as he found other computer games became boring once the player had mastered them. He claims Minoploy is a game which requires a reasonable blend of skill and luck and presents different challenges each time it is played. He adds that once the game gets down to a battle of wits between two players it can take some time to reach a conclusion.

Here are the uses of the main variables/arrays in the program.

A$(N) Name of player
A(N) Player's bank balance
Z(N) Player's "Symbol"
NO Number of players at start
NU Number of players left as the game progresses
Y Defines which player (e.g. his turn to go)
PO(Y) Position of a player "Y"
P(Y) Number of moves that player has made (0 to 24)
R( ) Rent or Debt to be collected etc.

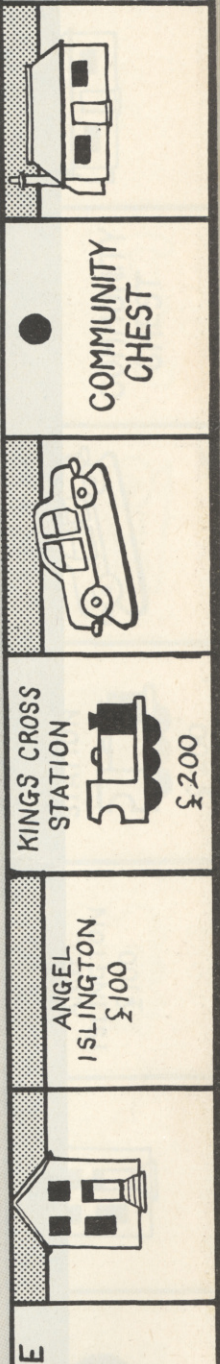

FREE PARKING
VINE STREET
£200
CHANCE
FOR SALE
BOW STREET
£180
ELECTRIC COMPANY
£150

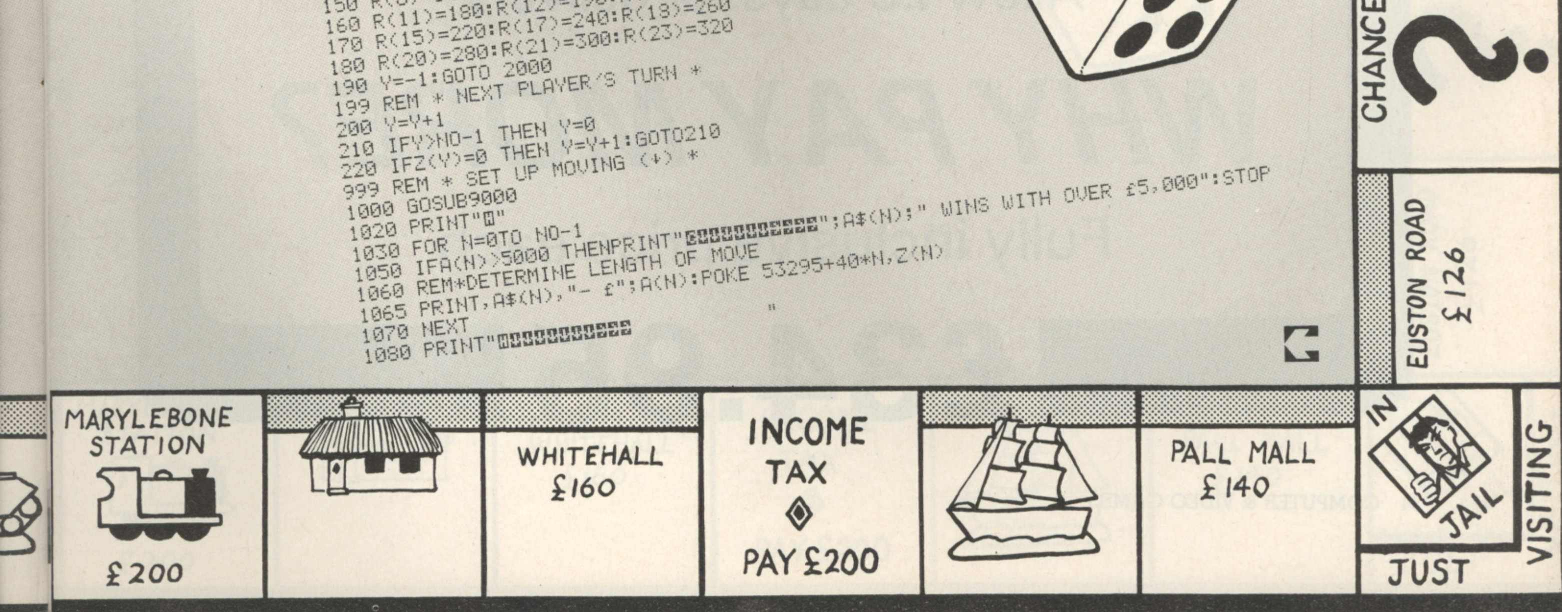

BOND STREET
£320
COMMUNITY
CHEST
FOR
SALE
SUPER
TAX
PAY £100
MAYFAIR
£400
GO
COLLECT
£200 SALARY
AS YOU PASS

```
1 PRINT"■
2 PRINT
3 PRINT                             * "
4 PRINT                MINOPOLY"
5 PRINT"      *
6 PRINT"
7 PRINT
8 PRINT                             * 
9 PRINT"      * COPYRIGHT - Mr.F.J.BUICK.
10 PRINT
11 PRINT                            *"
12 PRINT"    *    BANGOR,  Co. DOWN
13 PRINT                            *
14 PRINT"   *        N. IRELAND.
15 PRINT
16 PRINT
```

opoly

```
17 PRINT                                *
18 PRINT"       *     Written JANUARY 1982
19 PRINT
20 PRINT
21 PRINT                     DO YOU WANT INSTRUCTIONS"
22 FOR T=1TO5000:NEXT
50 PRINT"■■■■■■■■■■■           PRESS Y - for Yes, N - for No.
60 PRINT"■■
70 K$="":GET K$:IF K$=""THEN 70
80 IF K$="Y"THEN GOTO 8000
99 REM * SET UP ARRAYS & CONSTANTS *
100 S=53503:DIM P(4):DIM PO(4):DIM R(23):DIM Z(4):DIM F(23)
110 Z(0)=202:Z(1)=199:Z(2)=68:Z(3)=99:Z(4)=107
120 PO(0)=53651:PO(1)=53651
130 PO(2)=53651:PO(3)=53651:PO(4)=53651
140 R(1)=100:R(2)=110:R(3)=120:R(5)=130
150 R(6)=140:R(7)=150:R(9)=160:R(10)=170
160 R(11)=180:R(12)=190:R(14)=200
170 R(15)=220:R(17)=240:R(18)=260
180 R(20)=280:R(21)=300:R(23)=320
190 Y=-1:GOTO 2000
199 REM * NEXT PLAYER'S TURN *
200 Y=Y+1
210 IFY>NO-1 THEN Y=0
220 IFZ(Y)=0 THEN Y=Y+1:GOTO210
999 REM * SET UP MOVING (+) *
1000 GOSUB9000
1020 PRINT"■"
1030 FOR N=0TO NO-1
1050 IFA(N)>5000 THENPRINT"■■■■■■■■■■■■";A$(N);" WINS WITH OVER £5,000":STOP
1060 REM*DETERMINE LENGTH OF MOVE
1065 PRINT,A$(N),"- £";A(N):POKE 53295+40*N,Z(N)
                                    "
1070 NEXT
1080 PRINT"■■■■■■■■■■■■
```


COMMUNITY
CHEST
KINGS CROSS
STATION
£200
ANGEL
ISLINGTON
£100
CHANCE
?
EUSTON ROAD
£126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STATION
£200
WHITEHALL
£160
INCOME
TAX
PAY £200
PALL MALL
£140
IN
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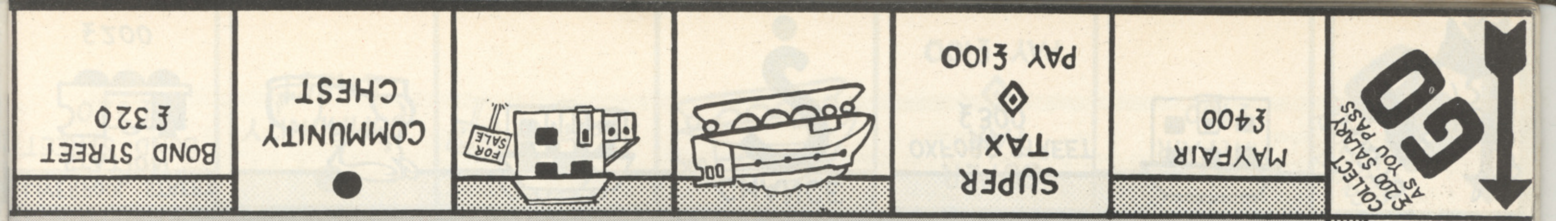
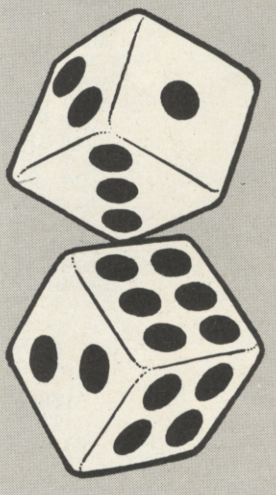

BOND STREET
£320
COMMUNITY
CHEST
FOR SALE
SUPER
TAX
PAY £100
MAYFAIR
£400
COLLECT
£200 SALARY
AS YOU PASS
GO

```
1090 PRINT"████";A$(Y);"-"
1100 POKE S+38,Z(Y)
1110 FOR N=0 TO 10
1120 POKE S+40+N,INT(RND(1)*5)+33
1130 NEXT
1140 POKE PO(Y)+Y,0:USR(62):POKE PO(Y)+Y,Z(Y):USR(62)
1200 FORQ=0TO10
1210 POKE S+Q,88
1220 FOR T=0 TO 1:NEXT
1230 POKE S+Q,0
1240 K$="":GET K$
1250 IFK$="S"THEN GOSUB 9000:GOTO 6030
1260 IF K$="*"THEN X=PEEK(S+Q+40)-32:POKE S+Q,88:GOTO4000
1270 IFK$=""THEN NEXT Q
1280 POKE PO(Y)+Y,0:USR(62):POKE PO(Y)+Y,Z(Y):USR(62)
1290 GOTO 1200
2000 REM * SET UP NUMBER & NAME OF PLAYERS & RANDOM TURN ORDER *
2010 PRINT"███████"
2020 INPUT"███     ENTER NUMBER OF PLAYERS- ";NO:NU=NO
2030 IF(NO<2)+(NO>5)THEN PRINT"█   YOU MUST CHOOSE BETWEEN 2 AND 5":GOTO 2020
2040 DIM A$(NO-1)
2050 X=INT(RND(1)*NO)
2060 INPUT"█████ENTER FIRST NAME  - ";A$(X)
2070 IFLEN(A$(X))>10THENPRINT,"(Max. 10 letters please)":PRINT"████":GOTO2060
2100 X=INT(RND(1)*NO)
2110 IF LEN(A$(X))>0 THEN 2100
2120 INPUT"███ENTER SECOND NAME - ";A$(X)
2130 IFLEN(A$(X))>10THENPRINT,"(Max. 10 letters please)":PRINT"██":GOTO2120
2140 IF NO=2 THEN 2500
2150 X=INT(RND(1)*NO)
2160 IF LEN(A$(X))>0 THEN 2150
2170 INPUT"███ENTER THIRD NAME  - ";A$(X)
2180 IFLEN(A$(X))>10THENPRINT,"(Max. 10 letters please)":PRINT"██":GOTO2170
2190 IF NO=3 THEN 2500
2200 X=INT(RND(1)*NO)
2210 IF LEN(A$(X))>0 THEN 2200
2220 INPUT"███ENTER FOURTH NAME - ";A$(X)
2230 IFLEN(A$(X))>10THENPRINT,"(Max. 10 letters please)":PRINT"██":GOTO2220
2240 IF NO=4 THEN 2500
2250 X=INT(RND(1)*NO)
2260 IF LEN(A$(X))>0 THEN 2250
2270 INPUT"███ENTER LAST NAME   - ";A$(X)
2280 IFLEN(A$(X))>10THENPRINT,"(Max. 10 letters please)":PRINT"██":GOTO2270
2500 PRINT"███████████████O.K. - FROM NOW ON :-"
2510 PRINT,"▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬"
2520 PRINT
2530 DIM A(NO-1)
2540 FOR N=0 TO NO-1
2550 PRINT"████";A$(N);" is represented by -":POKE 53564+N*80,Z(N)
2560 A(N)=6000/NO
2570 NEXT
2580 PRINT,"█████>>PRESS ANY KEY TO START<<"
2590 GET K$:IF K$=""THEN 2590
3000 REM * SET UP PLAYING BOARD *
3005 PRINT"█":FORM=8TO24 STEP4
3010 FORN=3TO37
3020 POKE53248+N+40*M,52
3030 NEXT N,M
3040 FOR M=11TO23 STEP4
3050 FORN=3TO37
3060 POKE53248+N+40*M,67
3070 NEXT N,M
3080 FORM=2TO38 STEP6
3090 FORN=8TO23
3100 POKE53248+40*N+M,121
3110 NEXT N,M
3120 FORM=10TO22 STEP4
3130 FORN=8TO32 STEP6
3140 POKE53248+N+40*M,90
3150 NEXT N,M
3160 FORM=12TO24 STEP4
3170 FORN=11TO35 STEP6
3180 POKE53248+N+40*M,69
3190 NEXT N,M
3200 POKE53810,80:POKE53970,80:POKE54130,80
3210 POKE53733,88:POKE53893,88:POKE54053,88
```



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CHEST
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STATION
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ANGEL
ISLINGTON
£100
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EUSTON ROAD
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STATION
£200
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GO TO JAIL
OXFORD STREET £300
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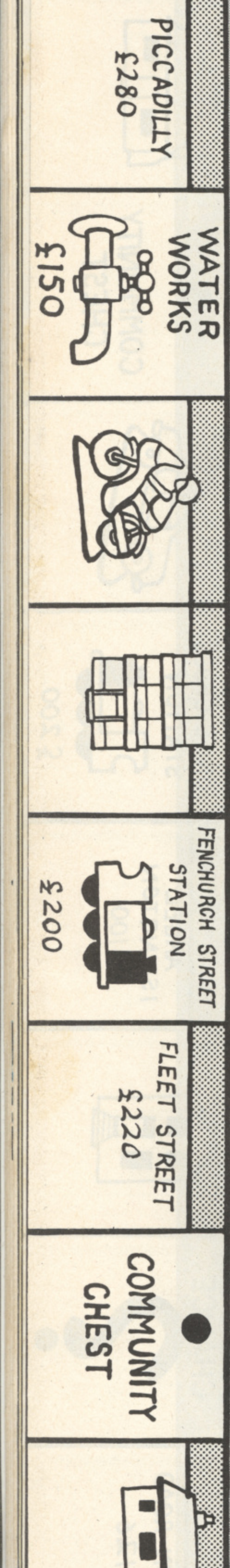
LIVERPOOL STREET STATION
£200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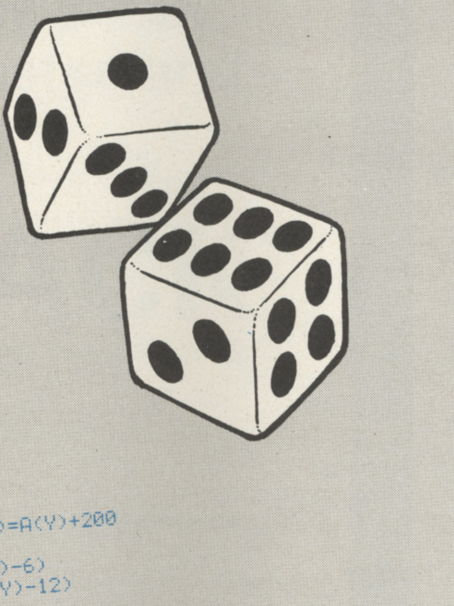
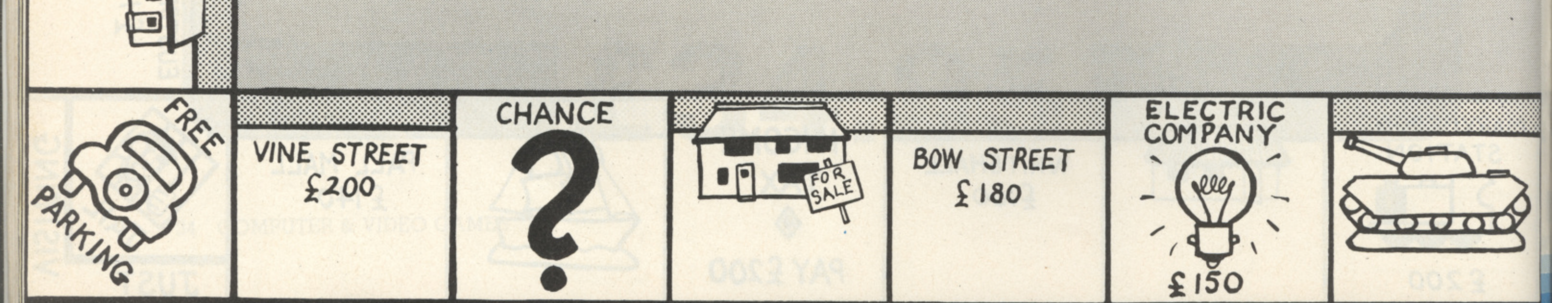
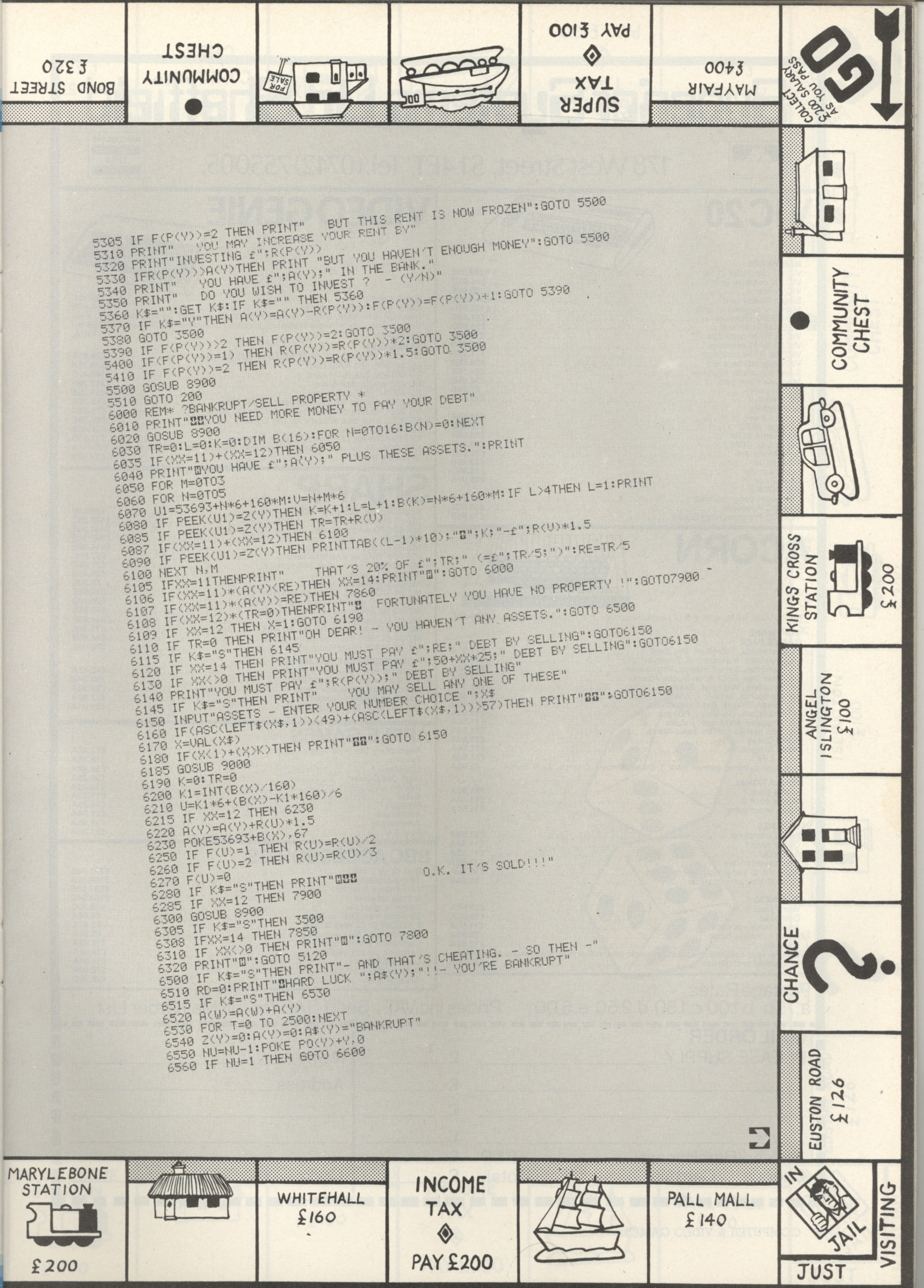
WATER WORKS
£150
FENCHURCH STREET STATION
£200
FLEET STREET
£220
COMMUNITY CHEST

```
3220 FOR N=0TO5
3230 FOR M=0TO3
3240 POKE53611+N*6+M*160,27
3250 NEXTM,N
3499 REM * ENTER/UPDATE RENTS ETC. *
3500 PRINT"▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮START▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮FREE"
3510 S$="▮▮▮▮▮▮"
3520 PRINT"▮▮▮▮▮";S$;R(1)
3530 PRINT"▮▮▮▮▮";S$;S$;R(2)
3540 PRINT"▮▮▮▮▮";S$;S$;S$;R(3)
3550 PRINT"▮▮▮▮▮";S$;S$;S$;S$;S$;R(5)
3560 PRINT"▮▮▮▮▮▮▮";R(6)
3570 PRINT"▮▮▮▮▮";S$;R(7)
3580 PRINT"▮▮▮▮";S$;S$;"?????"
3590 PRINT"▮▮▮▮▮";S$;S$;S$;R(9)
3600 PRINT"▮▮▮▮▮";S$;S$;S$;S$;R(10)
3610 PRINT"▮▮▮▮▮";S$;S$;S$;S$;S$;R(11)
3620 PRINT"▮▮▮▮▮▮▮";R(12)
3630 PRINT"▮▮▮▮▮";S$;"FREE"
3640 PRINT"▮▮▮▮▮";S$;S$;R(14)
3650 PRINT"▮▮▮▮▮";S$;S$;S$;R(15)
3660 PRINT"▮▮▮▮";S$;S$;S$;S$;"?????"
3670 PRINT"▮▮▮▮▮";S$;S$;S$;S$;S$;R(17)
3680 PRINT"▮▮▮▮▮▮▮";R(18)
3690 PRINT"▮▮▮▮";S$;"?????"
3700 PRINT"▮▮▮▮▮";S$;S$;R(20)
3710 PRINT"▮▮▮▮▮";S$;S$;S$;R(21)
3720 PRINT"▮▮▮▮▮";S$;S$;S$;S$;"FREE"
3730 PRINT"▮▮▮▮▮";S$;S$;S$;S$;S$;R(23)
3800 GOTO 200
4000 REM * MOVE PLAYERS *
4010 POKE PO(Y)+Y,0
4020 P(Y)=P(Y)+X:IFP(Y)>23 THEN P(Y)=P(Y)-24:A(Y)=A(Y)+200
4030 IFP(Y)<6 THEN PO(Y)=53651+P(Y)*6
4040 IF(P(Y)>5)*(P(Y)<12)THEN PO(Y)=53811+6*(P(Y)-6)
4050 IF(P(Y)>11)*(P(Y)<18)THEN PO(Y)=53971+6*(P(Y)-12)
4060 IF(P(Y)>17)THEN PO(Y)=54131+6*(P(Y)-18)
4070 POKE PO(Y)+Y,Z(Y)
5000 REM * SEE RESULT OF MOVE *
5010 V=PO(Y)+42
5020 IF(P(Y)=0)+(P(Y)=4)+(P(Y)=13)+(P(Y)=22)THEN 200
5030 IF(P(Y)=8)+(P(Y)=16)+(P(Y)=19)THEN7000
5040 IF(F(P(Y))=3)*(PEEK(V)=Z(Y))THEN 200
5050 GOSUB 9000
5060 PRINT"▮   O.K. ";A$(Y);" , YOU HAVE LANDED ON"
5065 IF PEEK(V)=67 THEN 5200
5070 IF PEEK(V)=Z(Y) THEN 5300
5075 IF PEEK(V)=202 THEN W=0
5080 IF PEEK(V)=199 THEN W=1
5085 IF PEEK(V)=68 THEN W=2
5090 IF PEEK(V)=99 THEN W=3
5095 IF PEEK(V)=107 THEN W=4
5100 PRINTA$(W);"'S PROPERTY."
5120 IFR(P(Y))>A(Y)THEN GOTO 6000
5130 PRINT"▮▮▮▮PAY OUT THE £";R(P(Y));" DUE !!!"
5135 FOR T=0 TO 2500:NEXT
5140 A(Y)=A(Y)-R(P(Y)):RD=0

5150 IFA(Y)<0THEN6500
5170 A(W)=A(W)+R(P(Y))
5180 GOTO 3500
5200 PRINT"A (FOR SALE) PROPERTY"
5210 IFR(P(Y))*2 >A(Y)THENPRINT"▮YOU DO'NT HAVE ENOUGH MONEY FOR IT":GOTO5500
5220 PRINT"   YOU HAVE £";A(Y);" IN THE BANK."
5230 PRINT"▮DO YOU WISH TO BUY FOR £";R(P(Y))*2 ;" (Y/N)"
5240 K$="":GET K$:IF K$="" THEN 5240
5250 IF K$="Y"THEN A(Y)=A(Y)-R(P(Y))*2 :POKE V,Z(Y)
5260 GOTO3500
5300 PRINT"YOUR OWN PROPERTY"
```




FREE PARKING
VINE STREET
£200
CHANCE
FOR SALE
BOW STREET
£180
ELECTRIC COMPANY
£150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SUPER
TAX
PAY £100
MAYFAIR
£400
GO
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JAIL
JUST
VISITING
PALL MALL
£140
INCOME
TAX
PAY £200
WHITEHALL
£160
MARYLEBONE
STATION
£200

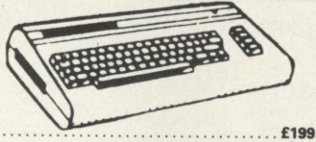
```
5305 IF F(P(Y))=2 THEN PRINT"   BUT THIS RENT IS NOW FROZEN":GOTO 5500
5310 PRINT"   YOU MAY INCREASE YOUR RENT BY"
5320 PRINT"INVESTING £";R(P(Y))
5330 IFR(P(Y))>A(Y)THEN PRINT "BUT YOU HAVEN'T ENOUGH MONEY":GOTO 5500
5340 PRINT"   YOU HAVE £";A(Y);" IN THE BANK."
5350 PRINT"   DO YOU WISH TO INVEST ?  - (Y/N)"
5360 K$="":GET K$:IF K$="" THEN 5360
5370 IF K$="Y"THEN A(Y)=A(Y)-R(P(Y)):F(P(Y))=F(P(Y))+1:GOTO 5390
5380 GOTO 3500
5390 IF F(P(Y))>2 THEN F(P(Y))=2:GOTO 3500
5400 IF(F(P(Y))=1) THEN R(P(Y))=R(P(Y))*2:GOTO 3500
5410 IF F(P(Y))=2 THEN R(P(Y))=R(P(Y))*1.5:GOTO 3500
5500 GOSUB 8900
5510 GOTO 200
6000 REM* ?BANKRUPT/SELL PROPERTY *
6010 PRINT"■■YOU NEED MORE MONEY TO PAY YOUR DEBT"
6020 GOSUB 8900
6030 TR=0:L=0:K=0:DIM B(16):FOR N=0TO16:B(N)=0:NEXT
6035 IF(XX=11)+(XX=12)THEN 6050
6040 PRINT"■YOU HAVE £";A(Y);" PLUS THESE ASSETS.":PRINT
6050 FOR M=0TO3
6060 FOR N=0TO5
6070 U1=53693+N*6+160*M:V=N+M*6
6080 IF PEEK(U1)=Z(Y)THEN K=K+1:L=L+1:B(K)=N*6+160*M:IF L>4THEN L=1:PRINT
6085 IF PEEK(U1)=Z(Y)THEN TR=TR+R(V)
6087 IF(XX=11)+(XX=12)THEN 6100
6090 IF PEEK(U1)=Z(Y)THEN PRINTTAB((L-1)*10);"■";K;"-£";R(V)*1.5
6100 NEXT N,M
6105 IFXX=11THENPRINT"    THAT'S 20% OF £";TR;" (=£";TR/5;")":RE=TR/5
6106 IF(XX=11)*(A(Y)<RE)THEN XX=14:PRINT"■":GOTO 6000
6107 IF(XX=11)*(A(Y)>=RE)THEN 7860
6108 IF(XX=12)*(TR=0)THENPRINT"■  FORTUNATELY YOU HAVE NO PROPERTY !":GOTO7900
6109 IF XX=12 THEN X=1:GOTO 6190
6110 IF TR=0 THEN PRINT"OH DEAR! - YOU HAVEN'T ANY ASSETS.":GOTO 6500
6115 IF K$="S"THEN 6145
6120 IF XX=14 THEN PRINT"YOU MUST PAY £";RE;" DEBT BY SELLING":GOTO6150
6130 IF XX<>0 THEN PRINT"YOU MUST PAY £";50+XX*25;" DEBT BY SELLING":GOTO6150
6140 PRINT"YOU MUST PAY £";R(P(Y));" DEBT BY SELLING"
6145 IF K$="S"THEN PRINT"    YOU MAY SELL ANY ONE OF THESE"
6150 INPUT"ASSETS - ENTER YOUR NUMBER CHOICE ";X$
6160 IF(ASC(LEFT$(X$,1))<49)+(ASC(LEFT$(X$,1))>57)THEN PRINT"■■":GOTO6150
6170 X=VAL(X$)
6180 IF(X<1)+(X>K)THEN PRINT"■■":GOTO 6150
6185 GOSUB 9000
6190 K=0:TR=0
6200 K1=INT(B(X)/160)
6210 U=K1*6+(B(X)-K1*160)/6
6215 IF XX=12 THEN 6230
6220 A(Y)=A(Y)+R(U)*1.5
6230 POKE53693+B(X),67
6250 IF F(U)=1 THEN R(U)=R(U)/2
6260 IF F(U)=2 THEN R(U)=R(U)/3
6270 F(U)=0
6280 IF K$="S"THEN PRINT"■■■                O.K. IT'S SOLD!!!"
6285 IF XX=12 THEN 7900
6300 GOSUB 8900
6305 IF K$="S"THEN 3500
6308 IFXX=14 THEN 7850
6310 IF XX<>0 THEN PRINT"■":GOTO 7800
6320 PRINT"■":GOTO 5120
6500 IF K$="S"THEN PRINT"- AND THAT'S CHEATING. - SO THEN -"
6510 RD=0:PRINT"■HARD LUCK ";A$(Y);"!!- YOU'RE BANKRUPT"
6515 IF K$="S"THEN 6530
6520 A(W)=A(W)+A(Y)
6530 FOR T=0 TO 2500:NEXT
6540 Z(Y)=0:A(Y)=0:A$(Y)="BANKRUPT"
6550 NU=NU-1:POKE PO(Y)+Y,0
6560 IF NU=1 THEN GOTO 6600
```

Superior Systems Ltd. Sheffield

178 West Street, S1 4ET. Tel. (0742) 755005.

BARCLAYCARD VISA

VIC 20



HARDWARE

VIC 20 computer (3.5k)	£199.99E
VIC 2N cassette unit	£44.95D
VIC printer	£230.00E
Single floppy unit	£396.00E
Memory expansion unit	£125.95D
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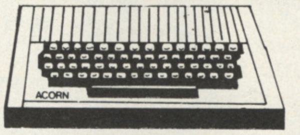
VIC BOOKS

Computer programming	£1.95A
The VIC Revealed	£10.00B
The VIC Programming Guide	£14.95B

ACORN



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Database	£10.00A
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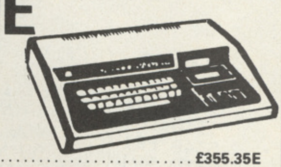
Atom business book	£6.95A
Desk diary	£10.00A
Special four cassette introductory pack; interactive teaching, financial, planning, household and games	£23.00A

VIDEO GENIE



Genie I computer	£355.35E
Genie II business computer	£355.00E
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EXPANSION

EG 3014 including 16K RAM card and disk interface	£228.85E
EG 3015/16 16K RAM card	£105.23B
EG 3015/32 32K RAM card	£148.12B
EG 400 single disk drive	£247.25E
EG 400AT dual disk drive	£431.25E
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EG 3021 double density adaptor for the EG 3014	£79.35C
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LE 19 EPROM unit	£30.48B
EP1 EPROM for LE 19 with Genie I functions	£13.80B
EP2 EPROM for LE 19 with single key commands, renumber and machine language monitor	£13.80B

SHARP

Sharp MZ80K computer (48K)	£399.00
MZ-80 I/O expansion unit	£109.25E
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MZ-80 FB dual floppy unit	£632.50E
MZ-80 P3 dot matrix printer	£414.00E
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MZ-80 8T70BE Basic compiler (f.dos)	£44.85B
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Disk drive (100K)	£265.00B
Teletext receiver	£165.99B
14in colour monitor	£287.50E
Prestel receiver	£104.54C
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5 pin DIN to 25 way D type	£9.50A
Cassette lead to 3 jack plug	£5.00A
Centronics printer cable	£18.40A
Seikosha printer cable	£18.40A
Games paddle	£13.00A
User guide	£10.00B
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Access/Barclaycard/ P&P. £______
Cheque. Card No____________ Total. £______

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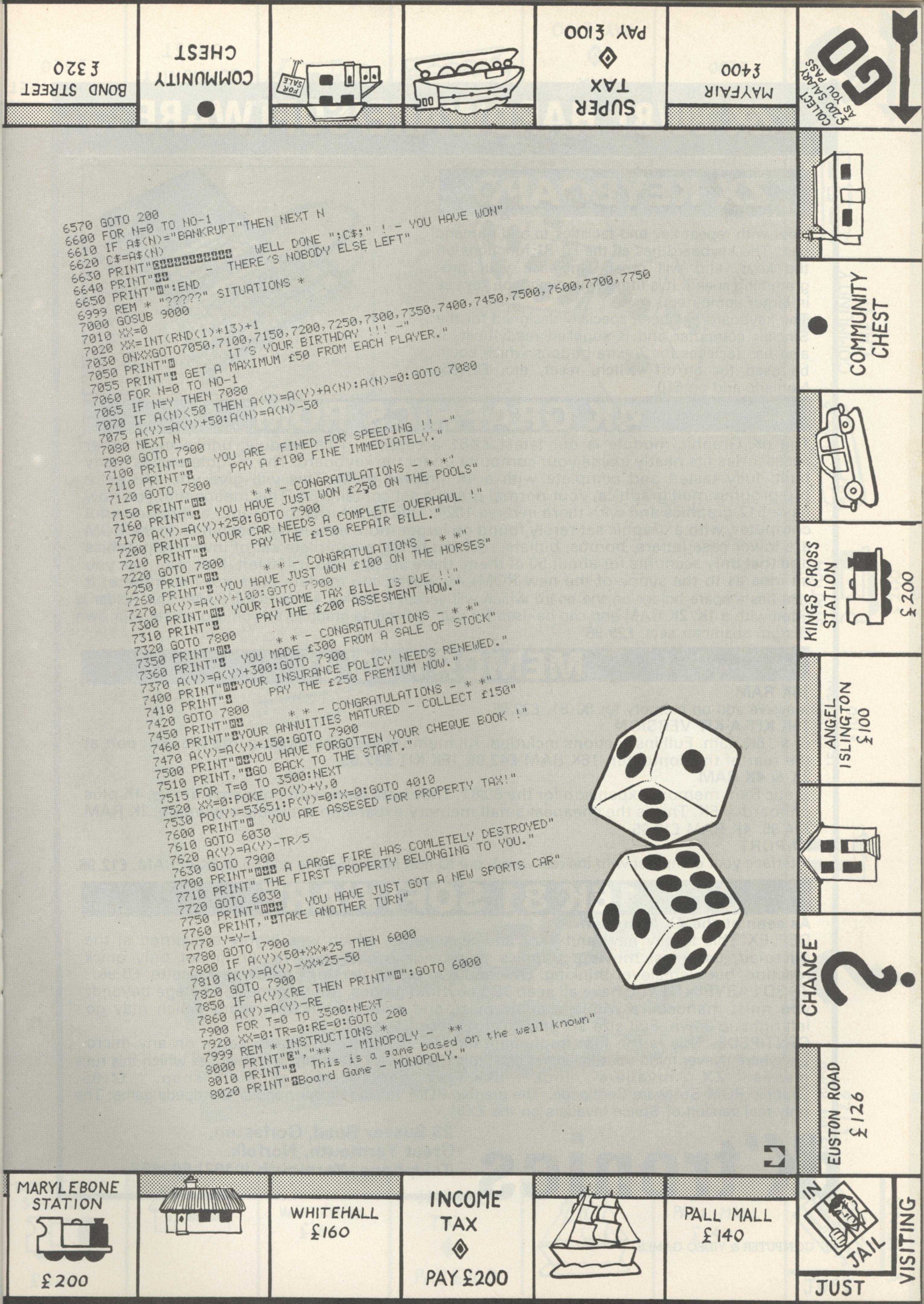
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FOR SALE
SUPER TAX
PAY £100
MAYFAIR
£400
COLLECT £200 SALARY AS YOU PASS
GO
COMMUNITY CHEST
KINGS CROSS STATION
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ANGEL ISLINGTON
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CHANCE
EUSTON ROAD
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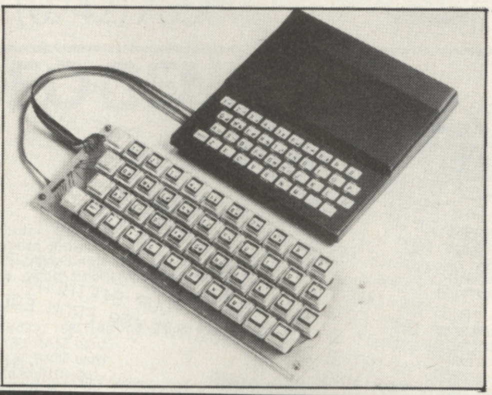
IN
JAIL
JUST
VISITING
PALL MALL
£140
INCOME TAX
PAY £200
WHITEHALL
£160
MARYLEBONE STATION
£200

```
6570 GOTO 200
6600 FOR N=0 TO NO-1
6610 IF A$(N)="BANKRUPT"THEN NEXT N
6620 C$=A$(N)
6630 PRINT"▮▮▮▮▮▮▮▮▮▮▮   WELL DONE ";C$;" ! - YOU HAVE WON"
6640 PRINT"▮▮          -  THERE'S NOBODY ELSE LEFT"
6650 PRINT"▮":END
6999 REM * "?????" SITUATIONS *
7000 GOSUB 9000
7010 XX=0
7020 XX=INT(RND(1)*13)+1
7030 ONXXGOTO7050,7100,7150,7200,7250,7300,7350,7400,7450,7500,7600,7700,7750
7050 PRINT"▮          IT'S YOUR BIRTHDAY !!! -"
7055 PRINT"▮ GET A MAXIMUM £50 FROM EACH PLAYER."
7060 FOR N=0 TO NO-1
7065 IF N=Y THEN 7080
7070 IF A(N)<50 THEN A(Y)=A(Y)+A(N):A(N)=0:GOTO 7080
7075 A(Y)=A(Y)+50:A(N)=A(N)-50
7080 NEXT N
7090 GOTO 7900
7100 PRINT"▮   YOU ARE  FINED FOR SPEEDING !! -"
7110 PRINT"▮      PAY A £100 FINE IMMEDIATELY."
7120 GOTO 7800
7150 PRINT"▮▮        * * - CONGRATULATIONS - * *"
7160 PRINT"▮  YOU HAVE JUST WON £250 ON THE POOLS"
7170 A(Y)=A(Y)+250:GOTO 7900
7200 PRINT"▮ YOUR CAR NEEDS A COMPLETE OVERHAUL !"
7210 PRINT"▮       PAY THE £150 REPAIR BILL."
7220 GOTO 7800
7250 PRINT"▮▮       * * - CONGRATULATIONS - * *"
7260 PRINT"▮ YOU HAVE JUST WON £100 ON THE HORSES"
7270 A(Y)=A(Y)+100:GOTO 7900
7300 PRINT"▮▮ YOUR INCOME TAX BILL IS DUE !!"
7310 PRINT"▮       PAY THE £200 ASSESMENT NOW."
7320 GOTO 7800
7350 PRINT"▮▮       * * - CONGRATULATIONS - * *"
7360 PRINT"▮  YOU MADE £300 FROM A SALE OF STOCK"
7370 A(Y)=A(Y)+300:GOTO 7900
7400 PRINT"▮▮YOUR INSURANCE POLICY NEEDS RENEWED."
7410 PRINT"▮       PAY THE £250 PREMIUM NOW."
7420 GOTO 7800
7450 PRINT"▮▮       * * - CONGRATULATIONS - * *"
7460 PRINT"▮YOUR ANNUITIES MATURED - COLLECT £150"
7470 A(Y)=A(Y)+150:GOTO 7900
7500 PRINT"▮▮YOU HAVE FORGOTTEN YOUR CHEQUE BOOK !"
7510 PRINT,"▮GO BACK TO THE START."
7515 FOR T=0 TO 3500:NEXT
7520 XX=0:POKE PO(Y)+Y,0
7530 PO(Y)=53651:P(Y)=0:X=0:GOTO 4010
7600 PRINT"▮  YOU ARE ASSESED FOR PROPERTY TAX!"
7610 GOTO 6030
7620 A(Y)=A(Y)-TR/5
7630 GOTO 7900
7700 PRINT"▮▮▮ A LARGE FIRE HAS COMLETELY DESTROYED"
7710 PRINT" THE FIRST PROPERTY BELONGING TO YOU."
7720 GOTO 6030
7750 PRINT"▮▮▮   YOU HAVE JUST GOT A NEW SPORTS CAR"
7760 PRINT,"▮TAKE ANOTHER TURN"
7770 Y=Y-1
7780 GOTO 7900
7800 IF A(Y)<50+XX*25 THEN 6000
7810 A(Y)=A(Y)-XX*25-50
7820 GOTO 7900
7850 IF A(Y)<RE THEN PRINT"▮":GOTO 6000
7860 A(Y)=A(Y)-RE
7900 FOR T=0 TO 3500:NEXT
7920 XX=0:TR=0:RE=0:GOTO 200
7999 REM * INSTRUCTIONS *
8000 PRINT"▮","**   - MINOPOLY -   **"
8010 PRINT"▮  This is a game based on the well known"
8020 PRINT"▮Board Game - MONOPOLY."
```

ZX 80/81 HARDWARE/SOFTWARE

ZX KEYBOARD



Now with repeat key and facilities to add numaric pad. The keyboard has all the 80/81 functions on the keys, and will greatly increase your programming speed. It is fitted with push type keys as in larger computers.
The keyboard has been specially designed for the Sinclair computer and is supplied ready-built. It also has facilities for 3 extra buttons which could be used for on/off switch, reset, etc. **£27.95.**
Numaric add on **£10.**

4K GRAPHICS ROM

The dK Graphic module is our latest ZX81 accessory. This module, unlike most other accessories fits neatly inside your computer under the keyboard. The module comes ready built, fully tested and complete with a 4K graphic ROM. This will give you 448 extra pre-programmed graphics, your normal graphic set contains 64. This means that you now have 512 graphics and with there inverse 1024. This now turns the 81 into a very powerful computer, with a graphic set rarely found on larger more expensive machines. In the ROM are lower case letters, bombs, bullets, rockets, tanks, a complete set of invaders graphics and that only accounts for about 50 of them, there are still about 400 left (that may give you an idea as to the scope of the new ROM). However, the module does not finish there; it also has a spare holder on the board which will accept a further 4K of ROM/RAM. This holder is fitted with a 1K/2K RAM and can be used for user defineable graphics so you can create your own custom charactor sets. **£29.95.**

MEMORY 80/ 81

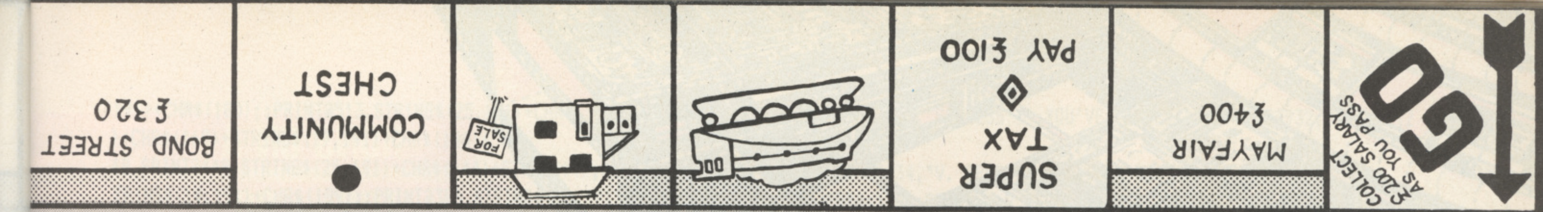
16K RAM
Massive add-on memory for 80/81. **£32.95.**
16K KIT-A-KIT VERSION
of a 16K Ram. Full instructions included. All memory expansions plug into the user port at the rear of the computer. 16K RAM **£42.95** 16K KIT **£32.95**
2K & 4K RAM
Static Ram memory expansion for the 80/81. They both work with onboard Ram i.e. 4K plus onboard = 5K. This is the cheapest small memory expansion available anywhere. 2K RAM **£14.95.** 4K RAM **£19.95.**
IO PORT
Interface your computer with the real world, our IO port has holders to add up to 6K of RAM. **£12.95.**

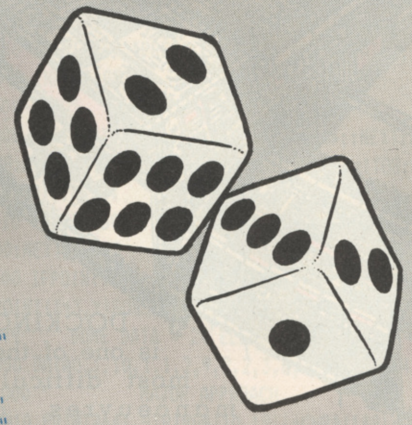
16K 81 SOFTWARE

As seen at the ZX Microfair.
DEFLEX This totally new and very addictive game, which was highly acclaimed at the Microfair, uses fast moving graphics to provide a challenge requiring not only quick reaction, but also clever thinking. One and two player versions on same cassette. £3.95
3D/3D LABYRINTH You have all seen 3D Labyrinth games, but this goes one stage beyond; you must manoeuvre within a cubic maze and contend with corridors which may go left/right/up/down. Full size 3D graphical representation. £3.95.
CENTIPEDE. This is the first implementation of the popular arcade game on any micro anywhere. Never mind your invaders, etc., this is positively stunning, the speed at which this runs makes ZX invaders look like a game of simple snap. £4.95.
Graphic ROM Software Centipede. The graphic ROM version of our popular Centipede game. The only real version of Space Invaders on the ZX81.

dK'tronics

23 Sussex Road, Gorleston,
Great Yarmouth, Norfolk.
Telephone: Yarmouth (0493) 602453


BOND STREET
£320
COMMUNITY CHEST
FOR SALE
SUPER TAX
PAY £100
MAYFAIR
£400
GO
COLLECT £200 SALARY AS YOU PASS

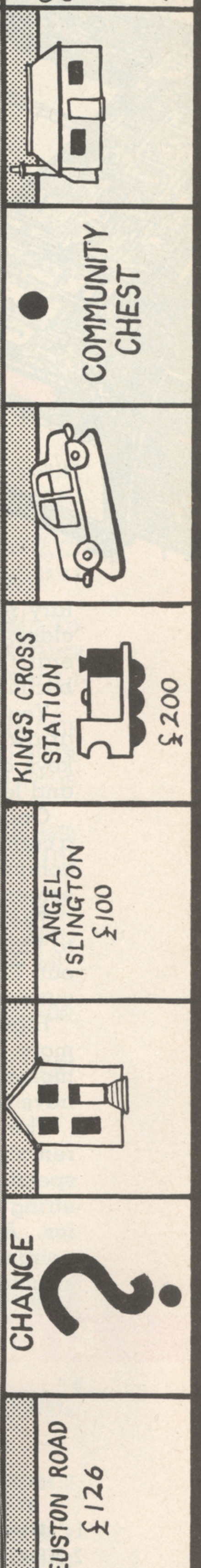


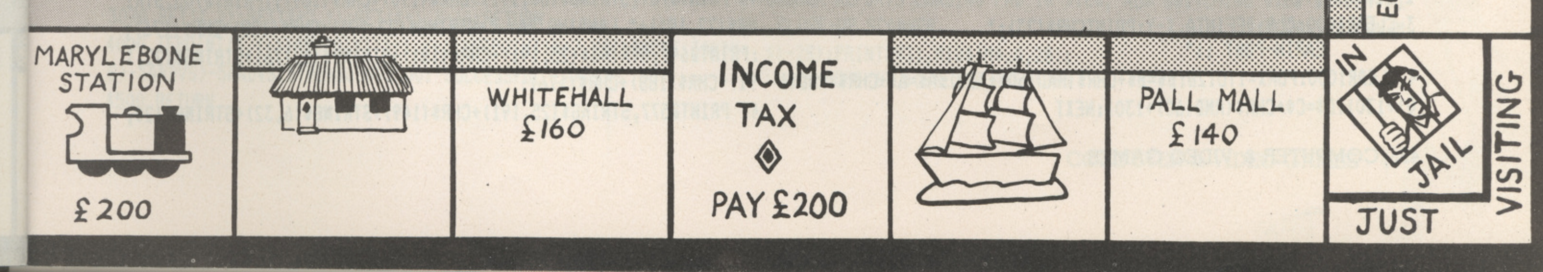
```
8030 PRINT"  £6,000 is divided equally amongst two"
8040 PRINT"to five players, who are then asked to"
8050 PRINT"enter their Christian Names."
8060 PRINT"  The winner is the one who, either"
8070 PRINT"survives Bankruptcy, or accumulates"
8080 PRINT"£5,000 or more in his Bank Account."
8090 PRINT"  Players take it in turn to move the"
8100 PRINT"number of spaces determined by trying to"
8110 PRINT"■stop the moving (↓) by pressing the"
8120 PRINT" >> CR << Key at the appropriate moment."
8130 PRINT"■  If you land on vacant Property, and"
8140 PRINT"you have enough money, you may buy it"
8145 PRINT"for twice it's Rental Value."
8150 PRINT"  If you land on your own Property, you"
8160 PRINT"may increase it's Rent by paying the"
8170 PRINT"Rental Value of it at that time. However"
8180 PRINT"■Rents are limited to 3 times their"
8190 PRINT"original value."
8200 PRINT"PRESS >> CR << KEY FOR MORE INFORMATION"
8210 PRINT"▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬"
8220 K$="":GET K$
8230 IF K$="" THEN 8220
8235 PRINT"■","**  - MINOPOLY -  **"
8240 PRINT"■  Rents have to be paid if you land on"
8250 PRINT"someone else's Property."
8260 PRINT"  By landing on the (?????) spaces you"
8270 PRINT"take a chance of gaining an advantage or"
8280 PRINT"■suffering a penalty."
8290 PRINT"  A current Bank Balance is displayed"
8300 PRINT"for each Player at the top of the screen"
8310 PRINT"■at the start of each one's turn."
8320 PRINT"  When it's his turn, a Player may sell"
8325 PRINT"his Property for one and a half times "
8330 PRINT"it's Rental Value, by pressing the (S)"
8340 PRINT"Key.   - But be careful, if you have no"
8350 PRINT"Property to sell, you will automatically"
8360 PRINT"■be declared Bankrupt."
8370 PRINT"■■      DO YOU WANT A REPEAT OF THESE",,"   INSTRUCTIONS"
8400 PRINT"■       PRESS Y - for Yes, N - for No."
8410 PRINT"       ▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬"
8420 GET K$:IF K$=""THEN 8420
8430 IF K$="Y"THEN GOTO 8000
8500 RUN 100
8900 FOR T=0 TO 3500
8950 NEXT
8999 REM * CLEAR TOP OF SCREEN *
9000 PRINT"■";SPC(39)
9010 PRINT SPC(39)
9020 PRINT SPC(39)
9030 PRINT SPC(39)
9040 PRINT SPC(39)
9050 PRINT SPC(39)
9060 PRINT SPC(39)
9070 PRINT SPC(39)
9080 RETURN
```

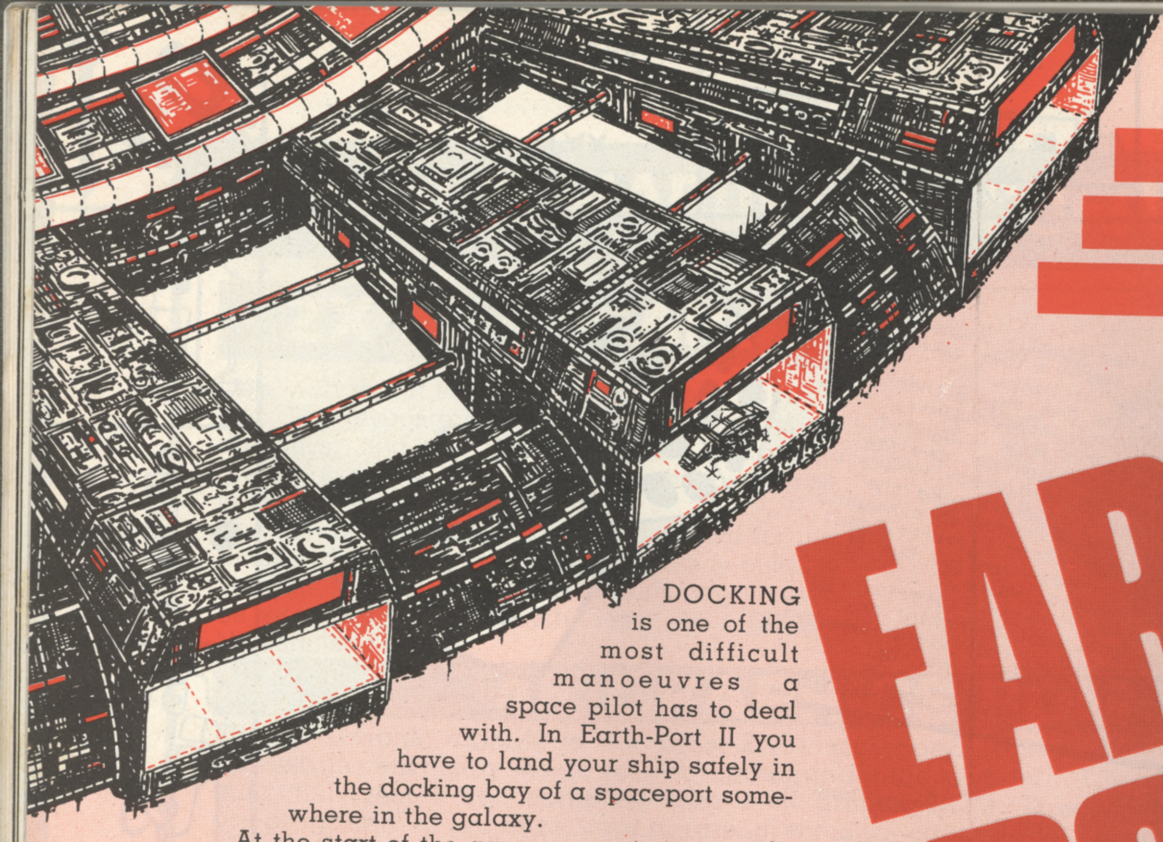
minopoly

RUNS ON A SHARP MZ-80K

BY FRED BUICK


COMMUNITY CHEST
KINGS CROSS STATION
£200
ANGEL ISLINGTON
£100
CHANCE
EUSTON ROAD
£126


MARYLEBONE STATION
£200
WHITEHALL
£160
INCOME TAX
PAY £200
PALL MALL
£140
IN
JAIL
JUST
VISITING



RUNS ON A
TRS — 80
IN 16K

EARTH PORT II

DOCKING is one of the most difficult manoeuvres a space pilot has to deal with. In Earth-Port II you have to land your ship safely in the docking bay of a spaceport somewhere in the galaxy.

At the start of the game you enter your military rank — you can chose between private first class, corporal, captain, major, colonel and general. The higher your rank, the harder the game becomes.

You control the spaceship by using the four arrow keys. The program will respond when two keys are pressed at once. For example the down and left arrows together.

Once you have guided your ship safely to within a certain proximity of the spaceport, your on-board computer will automatically switch your view screen to a close up view of the landing bay.

There's a slight catch to the game too. You have to land before your limited supply of oxygen runs out. The higher your rank the less oxygen you start out with.

High rank is obviously a big drawback — as the more stripes you have the greater the initial momentum of your ship. At the rank of general you have only seconds to prevent a fatal crash.

The variables are: O, the amount of oxygen remaining. HS, horizontal speed. VS, vertical speed. SL, rank or difficulty level. R$, where rank string is stored. X-Y, for next variables for graphics. A, display variable for use in displaying points. P-S, variables used the read data for constructing landing pad dome.

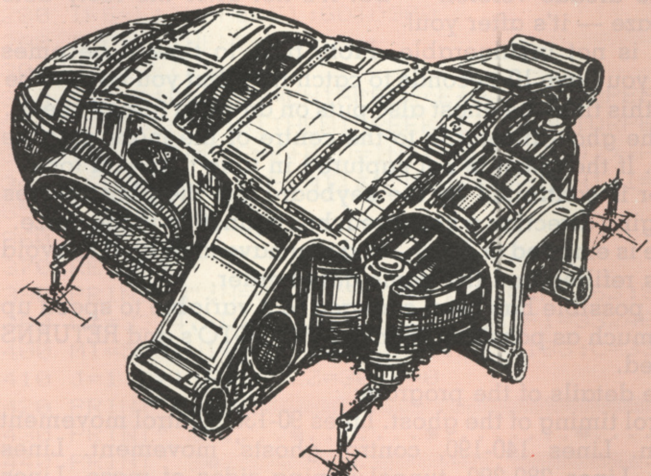
BY WILLIAM PHILLIP CASE

```
0 '
          EARTH-PORT II

          (C) COPYRIGHT 1980

          BY WILLIAM PHILLIP CASE, JR.
1 '**********************************
2 DEFINTX,Y,A
3 CLEAR1000:CLS:DEFINTA,X-Y:PRINTCHR$(23);"
       EARTH-PORT ii"
4 CLEAR1000:FORX=1TO128:B$=B$+CHR$(RND(60)+130):A$=A$+CHR$(RND(6
0)+130):C$=C$+CHR$(RND(60)+130):NEXT
```

```
5 CLS:PRINT:PRINTTAB(16)"ENTER YOUR RANK:":PRINT:PRINTTAB(24)"1.
PRIVATE FIRST CLASS":PRINTTAB(24)"2 CORPORAL":PRINTTAB(24)"3.C
APTAIN":PRINTTAB(24)"4 MAJOR":PRINTTAB(24)"5:COLONEL" PRINTTA
B(24)"6:GENERAL":INPUTSL:IFSL< 10RSL >60RSL< >INT(SL)THEN5
20 FORX=0TO127:SET(X,38):SET(X,0):SET(X,47):NEXT:FORY=0TO47:SET(
0,Y):SET(1,Y):SET(126,Y):SET(127,Y):NEXT:FORY=39TO46:SET(38,Y):S
ET(39,Y):SET(69,Y):SET(68,Y):NEXT:PRINT@877,"RANK:";:ONSLGOTO21,
22,23,24,25,26
21 R$="PRIVATE FIRST CLASS":GOTO30
22 R$="      CORPORAL":GOTO30
23 R$="      CAPTION":GOTO30
24 R$="       MAJOR":GOTO30
25 R$="      COLONEL":GOTO30
26 R$="     GENERAL":GOTO30
30 PRINT@934,R$;
35 X1=54:Y1=32
40 HS=SL*2:VS=-SL:O=30+(60-(SL*10)):X=10:Y=10
45 GOSUB11000: ' PERFORM PRIMARY APPROACH ROUTINE
46 PRINT@769,STRING$(60,191)+CHR$(190)+CHR$(189);:PRINT@705,STRI
NG$(22,191)+" LANDING BAY "+STRING$(22,191)+CHR$(188)+CHR$(176);
:PRINT@641,STRING$(25,191)+CHR$(181)+STRING$(6,176)+STRING$(22,1
91)+CHR$(188)+CHR$(176);
47 PRINT@577,STRING$(25,191)+CHR$(149)+STRING$(6,32)+STRING$(20,
191)+CHR$(180);:PRINT@513,STRING$(25,191)+CHR$(149)+STRING$(6,32
)+CHR$(168)+STRING$(17,191)+CHR$(180);
48 PRINT@449,STRING$(25,191)+CHR$(144)+STRING$(7,32)+CHR$(184)+S
TRING$(14,191)+CHR$(189);:PRINT@385,STRING$(24,191)+CHR$(181)+ST
RING$(9,32)+CHR$(186)+STRING$(10,191)+CHR$(181)+CHR$(144)+CHR$(1
76);
49 PRINT@321,STRING$(24,191)+CHR$(149)+STRING$(10,32)+CHR$(176)+
CHR$(180)+CHR$(184)+STRING$(7,191)+CHR$(148);:PRINT@257,STRING$(
24,191)+CHR$(148)+STRING$(13,32)+CHR$(170)+STRING$(3,191)+CHR$(1
76)+CHR$(160)+CHR$(144);
50 PRINT@193,STRING$(22,191)+CHR$(190)+CHR$(189)+STRING$(15,32)+
STRING$(2,191)+CHR$(148);:PRINT@129,STRING$(19,191)+CHR$(189)+CH
R$(176)+STRING$(18,32)+CHR$(160)+CHR$(180);
51 PRINT@65,STRING$(19,191)+CHR$(149);:PRINT@1,STRING$(19,191)+C
HR$(147);
53 X=50:Y=4
55 GOSUB1000:' GET REPORTS
60 GOSUB2000:'   INPUT VALUES
65 O=O-1
70 IFO<0GOTO200
75 GOSUB3000
78 GOSUB7000
80 GOSUB4000
100 GOTO55
200 PRINT@868,"YOU HAVE RAN OUT OF OXYGEN,";:PRINT@937,"YOU ARE
DEAD!!!";:FORA=1TO1900:NEXT:GOTO5
1000 PRINT@834,"V. SPEED =";INT(VS*100);" ";:PRINT@898,"H. SPEED
 =";INT(HS*100);" ";:PRINT@853,"OXYGEN =";O;:IFO<20PRINT@917,"OX
YGEN LOW!!";
```



```
1010 RETURN
2000 IFPEEK(14400)=8THENVS=VS+1ELSEIFPEEK(14400)=16THENVS=VS-1
2005 IFPEEK(14400)=32THENHS=HS-1ELSEIFPEEK(14400)=64THENHS=HS+1
2010 IFPEEK(14400)=40GOSUB2100
2015 IFPEEK(14400)=72GOSUB2105
2020 IFPEEK(14400)=48GOSUB2110
2025 IFPEEK(14400)=80GOSUB2115
2099 RETURN
2100 HS=HS-1:VS=VS+1:RETURN
2105 HS=HS+1:VS=VS+1:RETURN
2110 HS=HS-1:VS=VS-1:RETURN
2115 HS=HS+1:VS=VS-1:RETURN
3000 RESET(X,Y):RESET(X+2,Y):RESET(X+1,Y-1):X=X+HS:Y=Y-VS:IFX>12
2THENX=122ELSEIFX<3THENX=3
3010 IFY<3THENY=3ELSEIFY>36THENY=36
3015 IFPOINT(X+1,Y-1)ORPOINT(X+1,Y)ORPOINT(X+2,Y)THEN6000
3020 SET(X,Y):SET(X+2,Y):SET(X+1,Y-1):RETURN
4000 IFPOINT(X,Y+1)ANDPOINT(X+1,Y+1)ANDPOINT(X+2,Y+1)ANDHS<3ANDH
S>-3ANDVS>-5ANDVS<5THENGOSUB5000:'SUCCESSFUL LANDING
4500 RETURN
5000 PRINT@868,"SUCCESS!!! YOU'VE LANDED!!";:PRINT@932,STRING$(2
5,32);
5005 PRINT@834,"V. SPEED = 0  ";:PRINT@898,"H. SPEED = 0  ";
5010 FORA=1TO6:READP,Q,R,S:SET(X1+P,Y1-Q):SET(X1+R,Y1-S):FORB=1T
O50:NEXTB,A:RESTORE
5020 O=INT(((O*15)*SL/2)):R=O/100:FORA=1TO100:PRINT@932,"POINTS
=";A*R;:NEXTA:PRINT@932,"POINTS =";O;".........";
5030 PRINT@867,"PRESS ENTER TO PLAY AGAIN";
5040 INPUTA:GOTO5
5500 GOTO5
6000 CLS:FORX=1TO4:FORY=1TO8:PRINTA$;:NEXT:PRINTCHR$(28);:FORY=1
TO8:PRINTB$;:NEXT:PRINTCHR$(28);:FORY=1TO8:PRINTC$;:NEXTY:PRINTC
HR$(28);:NEXTX
6010 PRINT@460,"YOU CRASHED!!!!     YOU ARE DEAD!!!!";:FORA=1TO1
900:NEXT:GOTO5
7000 IFPOINT(X,Y-1)ORPOINT(X+1,Y)ORPOINT(X+2,Y-1)ORPOINT(X-1,Y)O
RPOINT(X+3,Y)GOSUB6000ELSERETURN
8999 '   DOME DATA = 24 ELEMENTS
9000 DATA0,1,10,1,1,2,9,2,2,3,8,3,3,4,7,4,4,5,6,5,5,5,5,5
11000 '          MAJOR APPROACH
11010 PRINT@641,STRING$(10,191)+CHR$(149);
11011 PRINT@705,STRING$(11,191)+CHR$(188)+STRING$(50,191);:PRINT
@769,STRING$(62,191);:PRINT@653,CHR$(190)+STRING$(29,191)+CHR$(1
89)+CHR$(180)+CHR$(184)+CHR$(188)+STRING$(16,191);
11012 PRINT@577,STRING$(9,191)+CHR$(188)+CHR$(148)+STRING$(2,32)
+CHR$(160)+CHR$(190)+STRING$(25,191)+CHR$(181)+CHR$(176)+CHR$(14
4)+STRING$(3,32)+CHR$(176)+CHR$(184)+STRING$(14,191);
11013 PRINT@513,STRING$(7,191)+CHR$(188)+CHR$(180)+STRING$(6,32)
+CHR$(176)+CHR$(190)+STRING$(17,191)+CHR$(181)+STRING$(2,176)+CH
R$(190)+CHR$(191)+CHR$(180)+STRING$(9,32)+CHR$(184)+STRING$(12,1
91);
11014 PRINT@449,STRING$(3,191)+CHR$(188)+CHR$(176)+CHR$(144)+STR
ING$(11,32)+CHR$(160)+CHR$(184)+STRING$(14,191)+CHR$(188)+STRING
$(3,32)+CHR$(160)+CHR$(180)+STRING$(12,32)+CHR$(168)+CHR$(190)+S
TRING$(9,191);
11015 PRINT@385,CHR$(188)+STRING$(19,32)+CHR$(176)+CHR$(190)+STR
ING$(9,191)+CHR$(189)+CHR$(176)+STRING$(20,32)+CHR$(176)+CHR$(18
4)+STRING$(7,191);
11016 PRINT@343,CHR$(184)+STRING$(7,191)+CHR$(180)+STRING$(25,32
)+CHR$(176)+CHR$(188)+CHR$(190)+STRING$(3,191);:PRINT@280,CHR$(1
60)+CHR$(190)+STRING$(4,191)+CHR$(144)+STRING$(28,32)+CHR$(160)+
CHR$(184)+STRING$(2,191);
11017 PRINT@218,CHR$(188)+CHR$(191)+CHR$(180)+STRING$(33,32)+CHR
$(176);:PRINT@155,CHR$(144);
11020 PRINT@612,CHR$(91)+CHR$(26)+STRING$(5,24)+" LANDING "+CHR$
(26)+STRING$(7,24)+" PAD ";
11030 GOSUB1000:X=5:Y=3
11035 O=O-1:IFO<0THEN200
11040 GOSUB1000:GOSUB2000:RESET(X,Y)
11050 X=X+(HS/2)
11060 Y=Y+(VS/2)*-1
11070 IFX<3THENX=3ELSEIFX>124THENX=124
11080 IFY<2THENY=2
11082 IFX>70ANDX<77ANDY>23ANDY<26THENRESET(X,Y):GOSUB12000:GOTO1
1900
11085 IFPOINT(X,Y)THEN6000
11090 SET(X,Y):GOTO11035
11900 FORA=65TO705STEP64:PRINT@A,STRING$(62,32);:NEXT:PRINT@769,
STRING$(62,176);
11999 RETURN
12000 PRINT@867,STRING$(27,32)+CHR$(26)+STRING$(27,24)+STRING$(2
7,32);
12001 M$="                         COMPUTER REPORT:  THE CLOSE-UP S
CANNER REPORTS LANDING PAD IN VIEW, NOW SWITCHING VIEW SCREEN TO
 CLOSE-UP SCANNER.                             ":FORA=1TO(LEN(M
$)-28):PRINT@931,MID$(M$,A,28);
12002 FORB=1TO10:NEXTB,A:RETURN
```

PUCK MAN

MUNCH your way around a maze in this adaptation of the popular arcade game. The deadly ghost which haunts this maze is just as hungry as in the arcade version — but it's not after the tasty dots which fill the maze — it's after you!

But the ghost is not invulnerable. From time to time it becomes luminous. Then you have 10 seconds to catch it — but you have to be quick as during this time the ghost also puts on an extra turn of speed.

If you catch the ghost it returns to the centre of the maze and the game continues. If the ghost is not captured in time then you lose.

Your character is controlled by the keyboard but the ghost moves randomly, changing direction when it reaches a junction in the maze.

Once the maze is emptied of dots — and you have managed to avoid the ghost — it is refilled and the game gets harder.

Every number possible has been changed to a variable to speed up the program as much as possible. Many of the GOTO's and RETURNS are also for speed.

Here are some details of the program:
Lines 50-70 control timing of the ghost. Lines 90-130, control movement of the Puckman. Lines 140-190, control ghosts' movement. Lines 210-260, scoring. Lines 280-290, tunnel joining sides of maze. Lines 310-320, random movement of ghost. Lines 380-410, variables. Lines 420-660 maze. Lines 780-1240, instructions.

BY SIMON MABLEY

RUNS ON A 40 COLUMN PET

IN 8K

```
 1 REM*** PUCKMAN ***
 2 REM
 3 REM*** BY S.P.MABLEY ***
 4 REM
 5 REM*** INSTRUCTIONS BY P.SALMON ***
 6 REM
 7 REM*** COPYRIGHT 1/2/82 ***
 8 REM
 10 PRINT"████████WOULD YOU LIKE INSTRUCTIONS?(Y/N)"
 20 GETA$:IFA$=""THEN20
 30 IFA$="Y"THEN780
 40 GOTO380
 50 IFJ=PANDVAL(TI$)>ITHENI=Q:K=R:J=N:TI$="000000":Z=P1
 60 IFJ=NANDVAL(TI$)>ITHEN710
 70 IFH>MTHENM=M+M:ZZ=20:Q=6:GOTO420
 80 A=PEEK(O)
 90 IFA=STHENB=T:POKEC,U:C=C-T:GOSUB180:POKEC,V:GOTO130
```

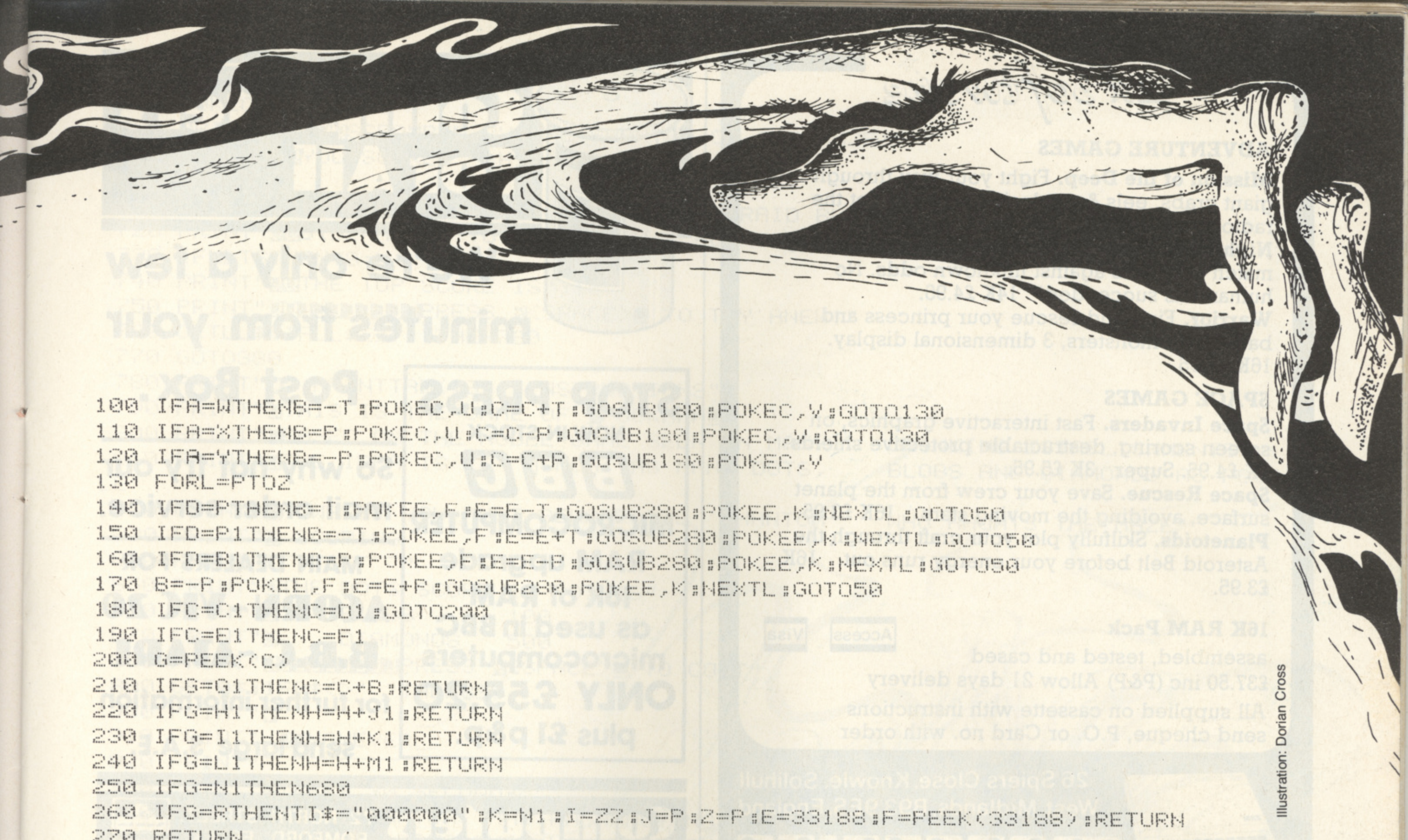


Illustration: Dorian Cross

```
100 IFA=WTHENB=-T:POKEC,U:C=C+T:GOSUB180:POKEC,V:GOTO130
110 IFA=XTHENB=P:POKEC,U:C=C-P:GOSUB180:POKEC,V:GOTO130
120 IFA=YTHENB=-P:POKEC,U:C=C+P:GOSUB180:POKEC,V
130 FORL=PTOZ
140 IFD=PTHENB=T:POKEE,F:E=E-T:GOSUB280:POKEE,K:NEXTL:GOTO50
150 IFD=P1THENB=-T:POKEE,F:E=E+T:GOSUB280:POKEE,K:NEXTL:GOTO50
160 IFD=B1THENB=P:POKEE,F:E=E-P:GOSUB280:POKEE,K:NEXTL:GOTO50
170 B=-P:POKEE,F:E=E+P:GOSUB280:POKEE,K:NEXTL:GOTO50
180 IFC=C1THENC=D1:GOTO200
190 IFC=E1THENC=F1
200 G=PEEK(C)
210 IFG=G1THENC=C+B:RETURN
220 IFG=H1THENH=H+J1:RETURN
230 IFG=I1THENH=H+K1:RETURN
240 IFG=L1THENH=H+M1:RETURN
250 IFG=N1THEN680
260 IFG=RTHENTI$="000000":K=N1:I=ZZ:J=P:Z=P:E=33188:F=PEEK(33188):RETURN
270 RETURN
280 IFE=E1THENE=F1:GOTO300
290 IFE=C1THENE=D1
300 N=PEEK(E)
310 IFD=P1ORD=PTHENIFPEEK(E+P)<>G1ORPEEK(E-P)<>G1THEND=INT(RND(TI)*Q1)+P
320 IFD=Q1ORD=B1THENIFPEEK(E+T)<>G1ORPEEK(E-T)<>G1THEND=INT(RND(TI)*Q1)+P
330 IFN=G1THENE=E+B:D=INT(RND(TI)*Q1)+P:RETURN
340 IFN=VANDK=RTHENTI$="000000":K=N1:I=ZZ:J=P:Z=P:E=33188:F=PEEK(33188):RETURN
350 IFN=VTHEN680
360 F=N
370 RETURN
380 PRINT"⊐":N=0:O=151:P=1:Q=10:R=163:S=50:T=40:U=32:V=193:W=18:X=42:Y=41:B1=
390 C1=33247:D1=33287:E1=33288:F1=33248:G1=102:H1=46:I1=81:J1=10:K1=100:L1=90
400 M1=500:N1=35:P1=2:Q1=4:E=33188:C=33348:K=35:TI$="000000":M=16250:I=45:Z=1
410 J=1:D=1:F=46:ZZ=30:H=0
420 PRINT"▤ ▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
430 PRINT" ▒.....●.......●........●........●....▒"
440 PRINT" ▒●▒▒▒▒▒▒▒▒.▒▒▒▒▒▒▒.▒▒▒▒▒▒▒▒.▒▒▒▒▒▒▒▒●▒"
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470 PRINT" ▒.▒....●✦▒.▒....●▒.▒●....▒.▒✦●.....▒.▒"
480 PRINT" ▒.▒▒▒▒▒▒▒▒.▒.....▒.▒.....▒.▒▒▒▒▒▒▒▒▒.▒"
490 PRINT" ▒................▒.▒.................▒"
500 PRINT" ▒.▒▒▒▒▒▒▒▒.▒▒▒▒▒▒▒.▒▒▒▒▒▒▒▒.▒▒▒▒▒▒▒▒.▒"
510 PRINT" ▒.▒....●✦▒.▒✦●..........●✦▒.▒✦●....▒.▒"
520 PRINT" ▒.▒.▒▒▒▒▒▒.▒▒▒▒▒▒▒▒.▒▒▒▒▒▒▒.▒▒▒▒▒..▒.▒"
530 PRINT"▒▒.▒.▒...........................▒..▒.▒▒";
540 PRINT".....▒●▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒●▒......";
550 PRINT"▒▒.▒.▒...........................▒..▒.▒▒";
560 PRINT" ▒.▒.▒▒▒▒▒▒.▒▒▒▒▒▒▒▒.▒▒▒▒▒▒▒.▒▒▒▒▒..▒.▒"
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590 PRINT" ▒................▒.▒.................▒"
600 PRINT" ▒.▒▒▒▒▒▒▒▒.▒.....▒.▒.....▒.▒▒▒▒▒▒▒▒▒.▒"
610 PRINT" ▒.▒....●✦▒.▒....●▒.▒●....▒.▒✦●.....▒.▒"
620 PRINT" ▒.▒.▒▒▒▒▒▒.▒▒▒▒▒▒▒.▒▒▒▒▒▒▒.▒▒▒▒▒▒▒.▒▒▒"
630 PRINT" ▒.▒................................▒.▒"
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650 PRINT" ▒.....●.......●.✦✦✦✦✦✦.●........●....▒"
660 PRINT" ▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒";
```

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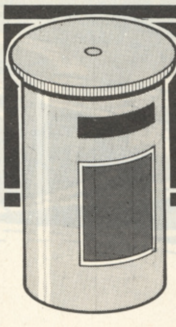

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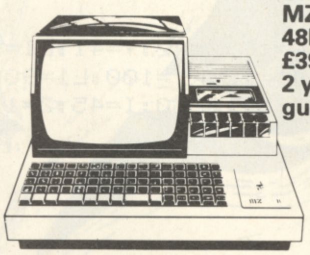

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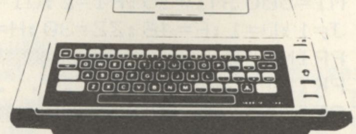

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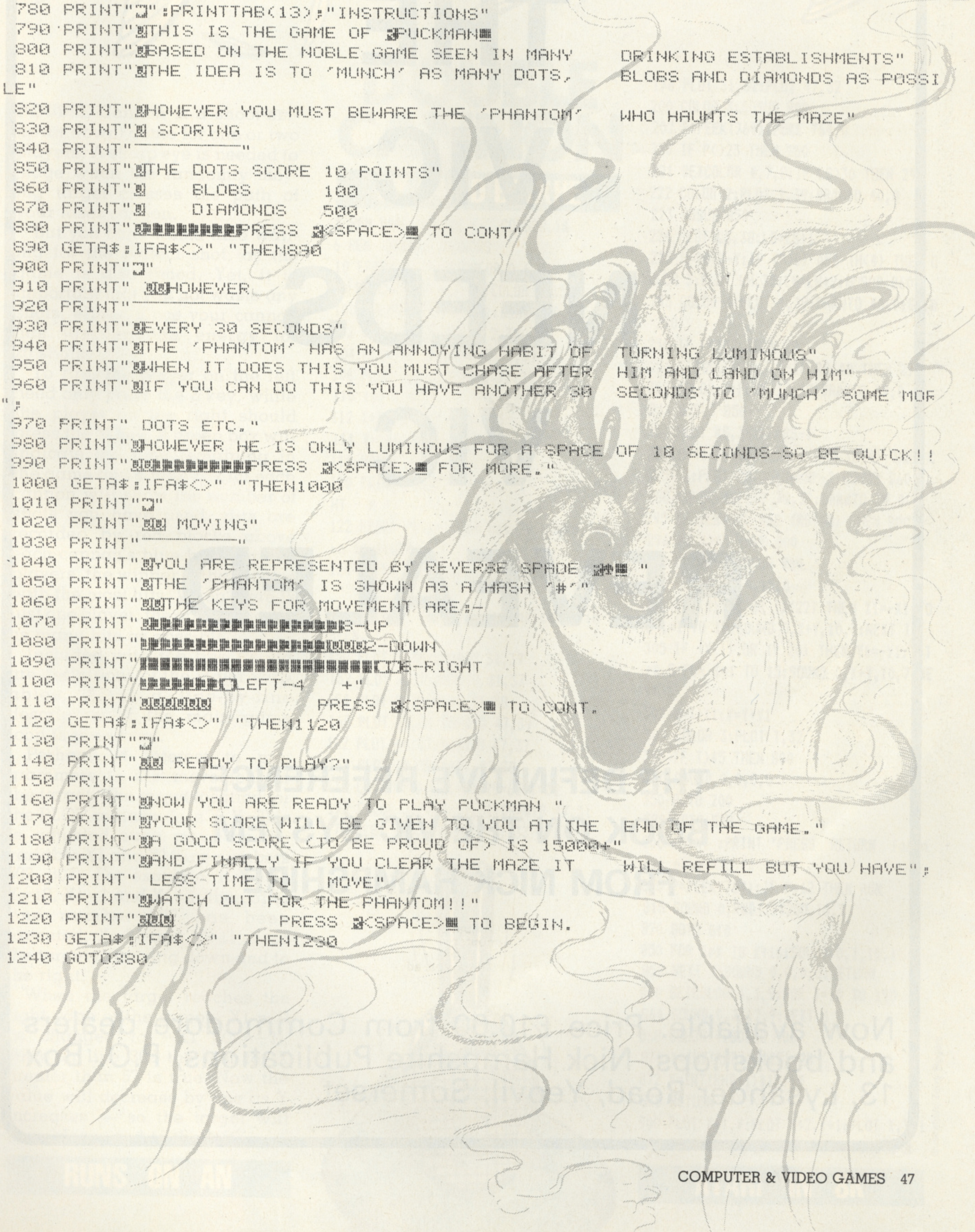
```
 670 POKEC,V:GOTO80
 680 PRINT"■■■■■SCROMPED BY THE PHANTOM OF THE MAZE!"
 690 PRINT"■■YOU SCORED ";H;" POINTS"
 700 GOTO730
 710 PRINT"■■■■■TIME RAN OUT ON YOU I'M AFRAID BUT YOU "
 720 PRINT"■■DID MANAGE TO SCORE ";H;" POINTS"
 730 IFH>TSTHENTS=H
 740 PRINT"■■THE TOP SCORE IS";TS
 750 PRINT"■■■■■■■■■■■PRESS ■<SPACE>■ TO TRY ANEW!"
 760 GETLL$:IFLL$<>" "THEN760
 770 GOTO380
 780 PRINT"■":PRINTTAB(13);"INSTRUCTIONS"
 790 PRINT"■THIS IS THE GAME OF ■PUCKMAN■
 800 PRINT"■BASED ON THE NOBLE GAME SEEN IN MANY    DRINKING ESTABLISHMENTS"
 810 PRINT"■THE IDEA IS TO 'MUNCH' AS MANY DOTS,    BLOBS AND DIAMONDS AS POSSI
LE"
 820 PRINT"■HOWEVER YOU MUST BEWARE THE 'PHANTOM'   WHO HAUNTS THE MAZE"
 830 PRINT"■ SCORING
 840 PRINT"──────────"
 850 PRINT"■THE DOTS SCORE 10 POINTS"
 860 PRINT"■     BLOBS        100
 870 PRINT"■     DIAMONDS     500
 880 PRINT"■■■■■■■■■■■PRESS ■<SPACE>■ TO CONT"
 890 GETA$:IFA$<>" "THEN890
 900 PRINT"■"
 910 PRINT" ■■HOWEVER
 920 PRINT"──────────"
 930 PRINT"■EVERY 30 SECONDS"
 940 PRINT"■THE 'PHANTOM' HAS AN ANNOYING HABIT OF  TURNING LUMINOUS"
 950 PRINT"■WHEN IT DOES THIS YOU MUST CHASE AFTER  HIM AND LAND ON HIM"
 960 PRINT"■IF YOU CAN DO THIS YOU HAVE ANOTHER 30  SECONDS TO 'MUNCH' SOME MOR
";
 970 PRINT" DOTS ETC."
 980 PRINT"■HOWEVER HE IS ONLY LUMINOUS FOR A SPACE OF 10 SECONDS-SO BE QUICK!!
 990 PRINT"■■■■■■■■■■■PRESS ■<SPACE>■ FOR MORE."
 1000 GETA$:IFA$<>" "THEN1000
 1010 PRINT"■"
 1020 PRINT"■■ MOVING"
 1030 PRINT"──────────"
 1040 PRINT"■YOU ARE REPRESENTED BY REVERSE SPADE ■■■ "
 1050 PRINT"■THE 'PHANTOM' IS SHOWN AS A HASH '#'"
 1060 PRINT"■■THE KEYS FOR MOVEMENT ARE:-
 1070 PRINT"■■■■■■■■■■■■■■■■■8-UP
 1080 PRINT"■■■■■■■■■■■■■■■■■■■■2-DOWN
 1090 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■6-RIGHT
 1100 PRINT"■■■■■■■LEFT-4    +"
 1110 PRINT"■■■■■■           PRESS ■<SPACE>■ TO CONT.
 1120 GETA$:IFA$<>" "THEN1120
 1130 PRINT"■"
 1140 PRINT"■■ READY TO PLAY?"
 1150 PRINT"──────────"
 1160 PRINT"■NOW YOU ARE READY TO PLAY PUCKMAN "
 1170 PRINT"■YOUR SCORE WILL BE GIVEN TO YOU AT THE  END OF THE GAME."
 1180 PRINT"■A GOOD SCORE (TO BE PROUD OF) IS 15000+"
 1190 PRINT"■AND FINALLY IF YOU CLEAR THE MAZE IT    WILL REFILL BUT YOU HAVE";
 1200 PRINT" LESS TIME TO   MOVE"
 1210 PRINT"■WATCH OUT FOR THE PHANTOM!!"
 1220 PRINT"■■■           PRESS ■<SPACE>■ TO BEGIN.
 1230 GETA$:IFA$<>" "THEN1230
 1240 GOTO380
```



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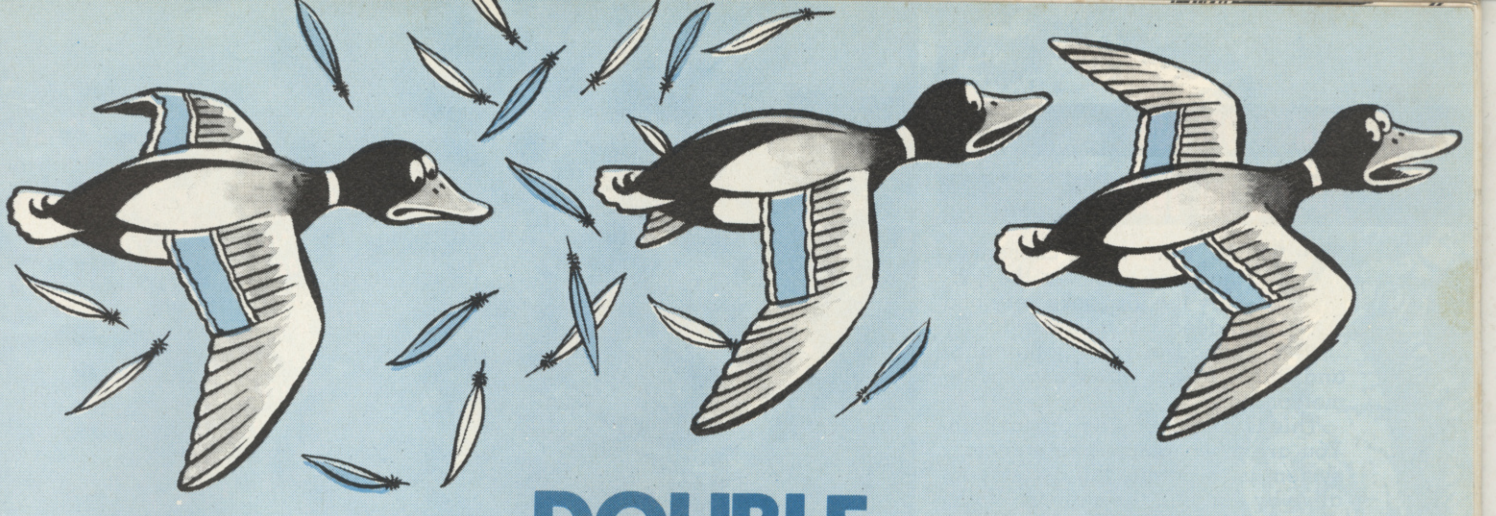


DOUBLE CANNON

BY DAVID BOLKHE

DOUBLE Cannon is a shoot-em-up (or down) game for one or two players. A sharp eye is needed to judge when the randomly moving target crosses the path of your laser cannon.

But you can't waste time waiting for the perfect shot, as the game is also timed. Yet, it is important that you not waste any shots, either, since your cannon has just enough energy for 20 shots.

To fire, the player on the left need only press the Z key, while the player on the right should press the M key. A green box will indicate the time remaining in the game and a blue box for each cannon will show the number of shots you have used. Hits are recorded by red blocks above each cannon's blue box. For two players, the winner is the shooter with the most hits. When there is just one player, the object is to get as many hits as possible.

Included with the line listing are definitions of the major variables. Also, a line-by-line description of the main game loop is presented.

Perhaps of interest to programmers is the movement of the target. The target location for the PLOT commands is X, Y. This is adjusted each move by the variable X1 and Y1 (line numbers 302, 307). For example; if X=30, Y=10, X1=1 and Y1=1, then after line number 307 has been executed, X=31 and Y=11 — so the target is moving down and to the right.

When the target reaches the right edge of the screen, X1 will be changed to −X1 (X1=−1), since in line 302 the test for X greater than 57 is true. Now the value will decrease by one as Y increases — so the target will move down and to the left.

RUNS ON AN ATARI IN 8K

```
5 REM DAVE BOHLKE     COGGON,IA
6 REM  DOUBLE CANNONS
10 GRAPHICS 5:SETCOLOR 0,6,7
20 SETCOLOR 2,4,7:SETCOLOR 4,15,8
100 COLOR 1:PLOT 8,31:DRAWTO 0,39
102 PLOT 9,32:DRAWTO 2,39
104 PLOT 71,31:DRAWTO 79,39
106 PLOT 70,32:DRAWTO 77,39
110 X1=1:Y1=1
112 X=INT(RND(1)*25)+25
114 Y=INT(RND(1)*15)+3
119 PRINT
120 PRINT " LEFT  press  Z  , and  RIG
HT   M "
122 PRINT "Each side has 20 shots, sho
wn in BLUE"
124 PRINT "HITS are displayed in RED.
 "
126 PRINT "Time left is indicated in G
REEN. ";
150 PLOT 9,39:DRAWTO 31,39
152 PLOT 9,37:DRAWTO 31,37
154 PLOT 9,38:PLOT 31,38
160 PLOT 69,39:DRAWTO 47,39
162 PLOT 69,37:DRAWTO 47,37
164 PLOT 69,38:PLOT 47,38
170 LH=9:RH=69:LS=10:RS=68:T=32
172 COLOR 2:PLOT 31,31:DRAWTO 47,31
174 PLOT 31,33:DRAWTO 47,33
176 PLOT 31,32:PLOT 47,32
200 COLOR 3:GOSUB 900
202 P=PEEK(764):POKE 764,0
220 IF P<>23 THEN 250
221 SETCOLOR 4,7,8:IF LS>30 THEN 290
222 COLOR 2:PLOT 1,39:DRAWTO 40,0
223 GOSUB 850
224 PLOT LS,38:LS=LS+1
225 H=40-X-Y:IF (H>0) AND (H<4) THEN C
OLOR 3:PLOT LH,35:LH=LH+2:GOSUB 860
245 COLOR 4:PLOT 1,39:DRAWTO 40,0:GOTO
 290
250 IF P<>37 THEN 290
251 SETCOLOR 4,7,8:IF RS<48 THEN 290
252 COLOR 2:PLOT 78,39:DRAWTO 39,0
253 GOSUB 850
254 PLOT RS,38:RS=RS-1
255 H=41-X+Y:IF (H>0) AND (H<4) THEN C
OLOR 3:PLOT RH,35:RH=RH-2:GOSUB 860
288 COLOR 4:PLOT 78,39:DRAWTO 39,0
290 IF (LS>30) AND (RS<48) THEN 800
296 IF T>45 THEN 800
300 COLOR 4:GOSUB 900
301 SETCOLOR 4,15,8
302 IF (X>57) OR (X<22) THEN X1=-X1:FO
R I=1 TO 15:SOUND 0,X+Y,10,7:NEXT I
305 IF (Y<1) OR (Y>20) THEN Y1=-Y1:T=T
+0.5:FOR I=1 TO 15:SOUND 0,X+Y,10,7:NE
XT I
307 X=X+X1:Y=Y+Y1
309 COLOR 3:PLOT T,32
320 IF T>45 THEN 800
330 SOUND 0,0,0,0
350 GOTO 200
599 GOTO 599
800 PRINT :PRINT "PRESS  RETURN  for n
ext game  ?  ";
810 P=PEEK(764):IF P=12 THEN RUN
815 SOUND 0,RND(1)*250,10,7
820 GOTO 810
850 FOR I=X TO X+10:SOUND 0,I,10,11
852 NEXT I:SOUND 0,0,0,0:RETURN
860 SETCOLOR 4,3,9:FOR J=10 TO 190
864 SOUND 0,J,12,9:NEXT J
868 COLOR 4:GOSUB 900
870 X=INT(RND(1)*25)+25
872 Y=INT(RND(1)*15)+5
878 RETURN
900 PLOT X+1,Y:PLOT X+2,Y+1:PLOT X,Y+1
904 PLOT X+1,Y+2:PLOT X+1,Y+1:RETURN
```

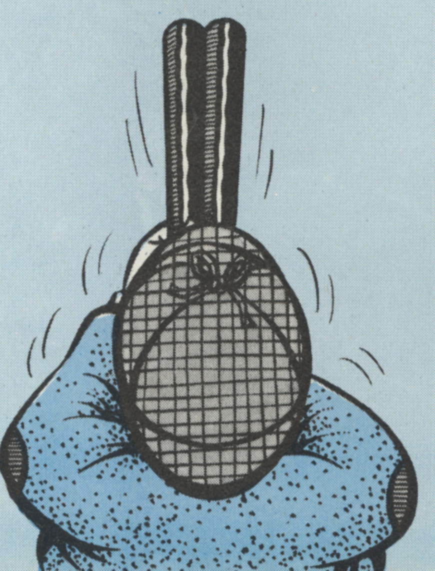


Illustration: Terry Rogers

RUNS ON AN APPLE IN 16K

YOU have been chosen as the best pilot for the job, only the job looks very bad indeed. You have to fly ahead of your mother ship and blast a path through a severe meteor storm.

This is also a paying proposition. You are given points (the monetary system is in points) for just staying alive by dodging the meteors. If you don't want to make your first million within your own lifetime, then just dodge.

But for each meteor you destroy you get 100 points. When the situation gets very dangerous, you can go into hyperspace. I must warn you to use this as few times as possible because you could come out of hyperspace right on top of a meteor, or be hopelessly lost in space. Within a short time, however, you will be navigating through the meteors with the best of them.

Now for the variable list:

A$- Used for temporary storage of INKEY$ and used all over.

E$ - this is what your shot looks like.

G - This is the PRINT at location of your shot. If it is zero, then you aren't shooting.

HP - High score

HP$ - The name of the high scorer.

I - Used for FOR-NEXT timer loops.

L - The location of your ship in video memory.

P - temporary storage for PEEK (14400).

PO - Your score.

S - PRINT at location of the ship.

S1, S2, S3 - PRINT at location of debris.

S$ - This is what your ship looks like.

S1$, S2$, S3$ - What the debris looks like.

T - Used for FOR-NEXT timer loops.

Y$ - Used to ask, "DO YOU WANT TO TRY ANOTHER MISSION?"

Now to explain myself a little.

First, the whole secret to this game is the screen's scrolling ability. When the screen is made to scroll, everything on it seems to go flying past. That is the way I made such a fast game with such a small amount of typing.

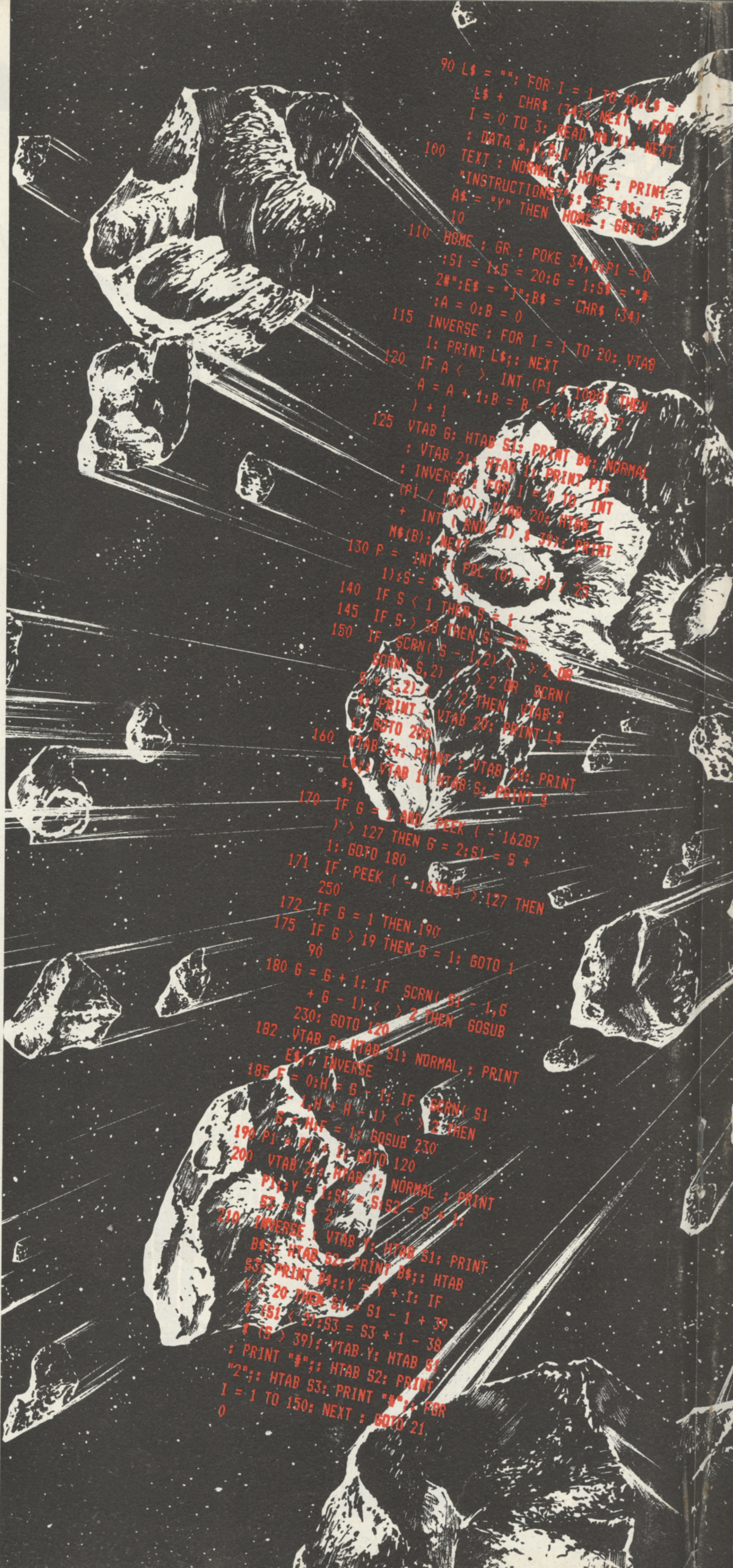
This, however, is the most useful technique I have found. You may have seen a table that has the keyboard memory on it.

Actually, there is no real memory between location 14336 and 15359.

It is a bunch of switches that were mapped into a place in memory.

The author, Mr Harper, says he encourages people to edit the daylights out of his program. So if you think you can make Meteor Storm a better game to play, feel free.

BY ROY HARPER

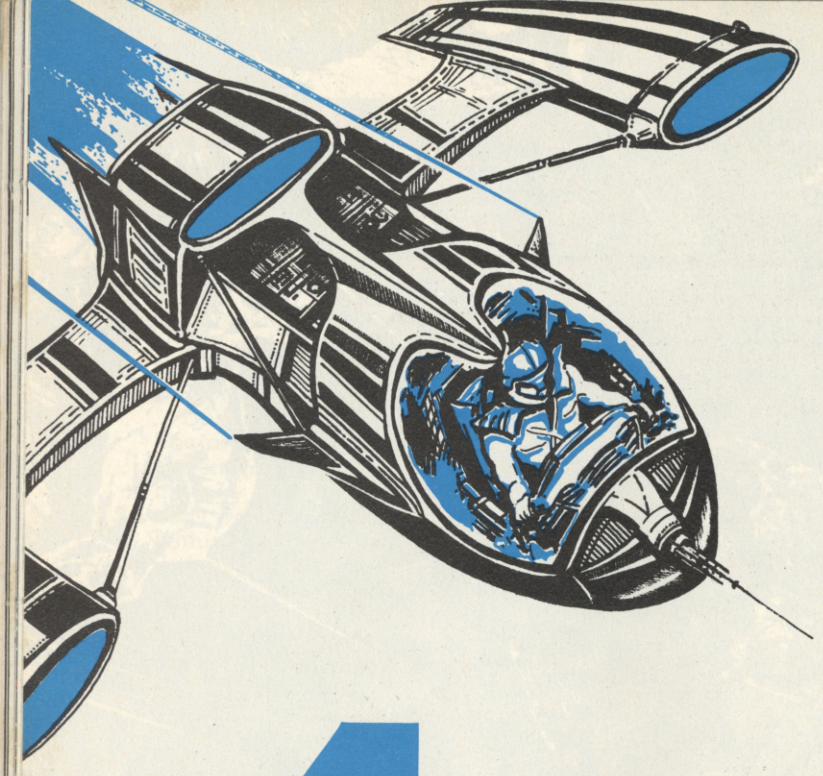


```
90 L$ = "": FOR I = 1 TO 40:L$ =
   L$ +  CHR$ (34): NEXT : FOR
   I = 0 TO 3: READ M$(I): NEXT
   : DATA @,H,D,X
100  TEXT : NORMAL : HOME : PRINT
   "INSTRUCTIONS?";: GET A$: IF
   A$ = "Y" THEN  HOME : GOTO 3
   10
110  HOME : GR : POKE 34,0:P1 = 0
   :S1 = 1:S = 20:G = 1:S$ = "#
   2#":E$ = "]":B$ =  CHR$ (34)
   :A = 0:B = 0
115  INVERSE : FOR I = 1 TO 20: VTAB
   I: PRINT L$;: NEXT
120  IF A < > INT (P1 / 1000) THEN
   A = A + 1:B = B - 4 * (B > 2
   ) + 1
125  VTAB G: HTAB S1: PRINT B$: NORMAL
   : VTAB 21: HTAB 1: PRINT P1;
   : INVERSE : FOR I = 0 TO  INT
   (P1 / 1000): VTAB 20: HTAB 1
   +  INT ( RND (1) * 39): PRINT
   M$(B): NEXT
130 P =  INT (( PDL (0) - 2) / 25
   1):S = S + P
140  IF S < 1 THEN S = 1
145  IF S > 38 THEN S = 38
150  IF  SCRN( S - 1,2) < > 2 OR
   SCRN( S,2) < > 2 OR  SCRN(
   S + 1,2) < > 2 THEN  VTAB 2
   4: PRINT : VTAB 20: PRINT L$
   ;: GOTO 200
160  VTAB 24: PRINT : VTAB 20: PRINT
   L$;: VTAB 1: HTAB S: PRINT S
   $;
170  IF G = 1 AND  PEEK ( - 16287
   ) > 127 THEN G = 2:S1 = S +
   1: GOTO 180
171  IF  PEEK ( - 16384) > 127 THEN
   250
172  IF G = 1 THEN 190
175  IF G > 19 THEN G = 1: GOTO 1
   90
180 G = G + 1: IF  SCRN( S1 - 1,G
   + G - 1) < > 2 THEN  GOSUB
   230: GOTO 120
182  VTAB G: HTAB S1: NORMAL : PRINT
   E$;: INVERSE
185 F = 0:H = G - 1: IF  SCRN( S1
   - 1,H + H - 1) < > 2 THEN
   G = H:F = 1: GOSUB 230
190 P1 = P1 + 1: GOTO 120
200  VTAB 21: HTAB 1: NORMAL : PRINT
   P1;:Y = 1:S1 = S:S2 = S + 1:
   S3 = S + 2
210  INVERSE : VTAB Y: HTAB S1: PRINT
   B$;: HTAB S2: PRINT B$;: HTAB
   S3: PRINT B$;:Y = Y + 1: IF
   Y < 20 THEN S1 = S1 - 1 + 39
   * (S1 < 2):S3 = S3 + 1 - 38
   * (S > 39): VTAB Y: HTAB S1
   : PRINT "#";: HTAB S2: PRINT
   "2";: HTAB S3: PRINT "#";: FOR
   I = 1 TO 150: NEXT : GOTO 21
   0
```

Illustration: Dorian Cross

METEOR STORM

```
220  NORMAL : FOR I = 1 TO 1000: NEXT
   : GOTO 270
230 P1 = P1 + 100: HTAB S1 - 1: VTAB
   G: PRINT "333": FOR T = 1 TO
   30: NEXT : HTAB S1 - 1: VTAB
   G: PRINT  CHR$ (34); CHR$ (3
   4); CHR$ (34): IF F = 1 THEN
   VTAB G + 1: HTAB S1: PRINT
   B$
235 G = 1: RETURN
250  INVERSE : POKE  - 16368,0:G =
   1: FOR I = 1 TO 10 +  RND (1
   ) * 70: VTAB 24: PRINT : VTAB
   20: HTAB 1: PRINT L$: VTAB 2
   0: HTAB I +  INT ( RND (1) *
   40): PRINT M$(B): NEXT : GOTO
   120
270  VTAB 22: IF P1 > HP THEN 360
275  HTAB 15: PRINT HP$;":";HP: PRINT
   "YOU EARNED ";P1;" POINTS ON
   THAT MISSION."
280  PRINT "DO YOU WANT TO TRY AN
   OTHER MISSION?";: GET A$: IF
   A$ < > "N" THEN 110
285  TEXT : HOME : END
310  FOR I = 1 TO 35: VTAB 24: HTAB
   1 +  RND (1) * 40: PRINT "O"
   : NEXT : HTAB 13: PRINT "MET
   EOR STORM": HTAB 13: PRINT "
   BY ROY HARPER": PRINT "APPLE
   TRANSLATION : GARON AND PEL
   CZARSKI"
320  PRINT : PRINT " YOUR MISSION
   IS TO BLAST A PATH THROUGHA
   SEVERE METEOR STORM.  YOU A
   RE ABLE TO STEER LEFT AND RI
   GHT USING PADDLE ZERO. YOUR
   MISSION ALSO INCLUDES DESTRO
   YING   METEORS (AT 100 POINT
   S EACH!).  LINE"
330  PRINT "YOURSELF UP WITH A ME
   TEOR AND PRESS THE PADDLE BU
   TTON TO FIRE.": PRINT " ANOT
   HER FEATURE OF YOUR SHIP IS
   ITS": PRINT "ABILITY TO ENTE
   R HYPERSPACE.  PRESS ANY KEY
   TO DO THIS. A WORD OF CAUTI
   ON: WHILEBEING IN HYPERSPACE
   DOES NOT ";
340  PRINT "ADD TO OR  SUBTRACT F
   ROM YOUR SCORE, IT MAY EVEN
   LAND YOU ON A METEOR (IN W
   HICH CASE -": PRINT "YOUR MI
   SSION IS OVER!)": PRINT : HTAB
   13: PRINT "GOOD LUCK!!!": PRINT
   : PRINT
350  HTAB 8: PRINT "PRESS ANY KEY
   TO BEGIN";: POKE  - 16368,0
   : GET A$: FOR I = 1 TO 20: POKE
   32,20 - I: POKE 33,2 * I: PRINT
   : PRINT : NEXT : FOR I = 1 TO
   24: PRINT : NEXT : GOTO 110
360  NORMAL :HP = P1: HTAB 1: PRINT
   "YOU GOT THE HIGH SCORE OF "
   ;HP: INPUT "ENTER YOUR NAME
   PLEASE: ";HP$: GOTO 280
```



ANTI GRAV FLIER

SWOOPING across the surface of the alien planet you prepare your ship for battle. Your laser cannon is armed as you look out for strategic targets. A city looms in front of you — and the attack is on!

In this arcade style game you are piloting an anti-grav air car. It is equipped with a laser and has two speeds — attack and super-fast Zype drive. The idea is to cause as much havoc and destruction in the city as you can.

But you must beware of the deadly super-force-field gravity traps. You have warning indicators which light up when you approach one of these danger zones. The game requires quick reactions and mental awareness.

If you want the fuel to last longer just modify the variable "F" in lines 1000 and 1980 — the greater the value the longer the fuel lasts.

As soon as the warning indicators light up alerting you to a danger zone the force-field trap will be placed directly in front of your flier at the bottom of the screen. Only the centre of your craft is affected by the hazards.

Although the game is written in easily understandable Basic Mr Firmin says it is quite fast in execution.

BY PAUL FIRMIN

```
10 REM        **** Anti Grav. Flier ****
20 REM A Prog. by P.E.Firmin (Futura Software)
30 REM Produced for Computer & Video Games Mag.
40 REM               Written Jan.1982
50 CLEAR 200
60 CLS:TS=0:T$="* ANTI GRAV FLIER *"
70 FOR T=1 TO LEN(T$)
80 POKE 3017+T,ASC(MID$(T$,T,1)):NEXT
90 T$="Futura Software (C) 1982"
100 FOR T=1 TO LEN(T$)
110 POKE 3041+T,ASC(MID$(T$,T,1)):NEXT
120 REM - Initialisation
130 DEF FNX(X)=INT(RND(1)*46)+1
140 DEF FNS(S)=INT(RND(1)*5)+1
150 DOKE 3200,25311:DOKE 3202,312
160 DOKE 3204,18351:DOKE 3206,10927
170 DOKE 3208,-8179:POKE 3210,233
180 DOKE 4100,3200
190 SCREEN 6,6
200 PRINT"Would you like instructions ";
210 PRINT"(Y or N) ?"
220 A=USR(0):IF A=0 THEN 220
230 IF A=89 THEN 1620
240 IF A=78 THEN 1960
250 GOTO 220
```

```
260 GOSUB 1460
270 X=25:Y=7:CK=1
280 REM - Main Game
290 SCREEN 1,15
300 A=USR(0)
310 F=F-1:IF F<=0 THEN GOSUB 1000
320 IF PEEK (3074)=64 THEN Y=Y-1
330 IF PEEK (3075)=64 THEN X=X-1
340 IF PEEK (3076)=64 THEN Y=Y+1
350 IF PEEK (3077)=64 THEN X=X+1
360 IF PEEK (3079)=16 THEN CK=1
370 IF PEEK (3079)=8 THEN CK=2
380 IF X<2 THEN X=2
390 IF X>47 THEN X=47
400 IF Y>14 THEN Y=14
410 IF Y<2 THEN Y=2
420 POKE W,32:POKE W-1,32:POKE W+1,32
430 PRINT:IF CR=1 THEN 1070
440 IF CK=2 THEN PRINT
450 P=1993+X+Y*64
460 IF PEEK (P+64)=255 THEN CR=1
470 IF PEEK(P)=255 THEN CR=1
480 IF PEEK (P)=160 THEN 1130
490 POKE P,170:POKE P-1,92:POKE P+1,47
500 IF PEEK (3080)=16 THEN GOSUB 690
510 A=USR(0):W=P
520 REM - Plot Planet Surface
530 IF RND(1)<.9 THEN POKE 2954+FNX(X),255
540 IF RND(1)>.1 THEN 600
550 RESTORE 570:RN=FNS(S)
560 FOR V=1 TO RN:READ CH:NEXT
570 DATA 7,186,14,7,14
580 POKE 2954+FNX(X),CH
590 REM - Detect & Set Up Grav Force-Field
600 IF K=0 THEN 640
610 K=K+1
620 IFK=16 THEN K=0:POKE 3018,184:POKE 3036,184
630 GOTO 300
640 IF RND(1)<.95 THEN 300
650 K=1:POKE 2953+X,160
660 POKE 3018,185:POKE 3036,185
670 GOTO 300
680 REM - Fire Laser Gun
690 FOR I=1 TO 6
700 L=P+I*64:IF L>3001 THEN 740
710 PK=PEEK (L):IF PK<>32 THEN 810
720 POKE L,148
730 NEXT
740 ST=I-1
750 FOR J=1 TO ST
760 L=P+J*64
770 POKE L,32
780 NEXT
790 RETURN
800 REM - Laser Hit
810 IF PK=7 OR PK=14 THEN 840
820 IF PK=186 THEN 950
830 GOTO 740
840 POKE L,42
850 RESTORE 930:RN=FNS(S)
860 FOR T=1 TO RN:READ SC:NEXT
870 TC=TC+SC
880 S$=STR$(SC):FOR T=1 TO LEN(S$)
890 POKE L-3+T,ASC(MID$(S$,T,1)):NEXT
900 S$=STR$(TC):FOR T=1 TO LEN(S$)
910 POKE 3043+T,ASC(MID$(S$,T,1)):NEXT
920 GOTO 740
930 DATA 50,100,150,200,300
940 REM - Hit Fuel Supply
950 POKE L,129
960 IF FL=10 THEN 740
970 FL=FL+1:POKE PZ,128:PZ=PZ+1
980 GOTO 740
990 REM - Fuel Check
1000 FL=FL-1:F=50:PZ=PZ-1:POKE PZ,32
1010 IF FL=0 THEN 1030
1020 RETURN
1030 GOSUB 1460:SCREEN 17,4
1040 PRINT"++ OUT OF FUEL ++"
1050 GOTO 1300
1060 REM - Crashed
1070 FOR T=1 TO 3:RESTORE 1110:FOR I=1 TO 7
1080 READ CH:POKE P,CH:POKE P-1,CH:POKE P+1,CH
1090 NEXT:NEXT
1100 N=1:GOTO 1220
1110 DATA 42,129,4,255,158,127,42
1120 REM - Super Gravity Force Field
1130 FOR T=1 TO 5:CH=64
1140 POKE P,CH:POKE P+1,CH
1150 POKE P-63,CH:POKE P+2,CH
1160 POKE P-64,CH:POKE P-65,CH
1170 POKE P-2,CH:POKE P-1,CH
1180 POKE P+63,CH:POKE P+64,CH:POKE P+65,CH
```

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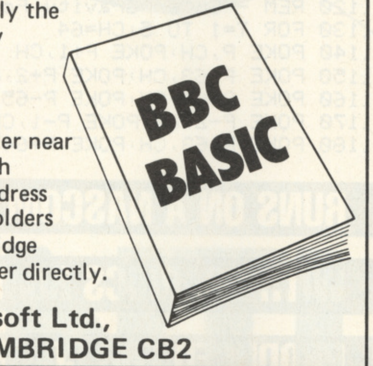

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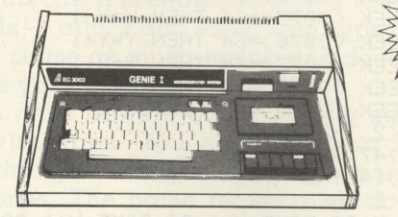

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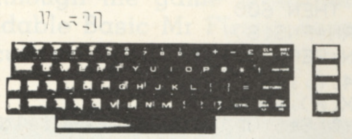

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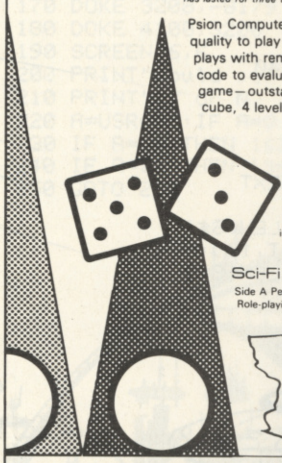

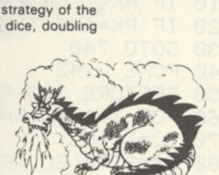

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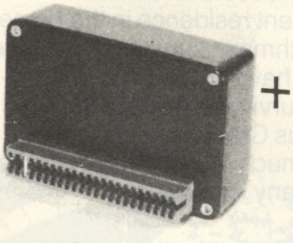

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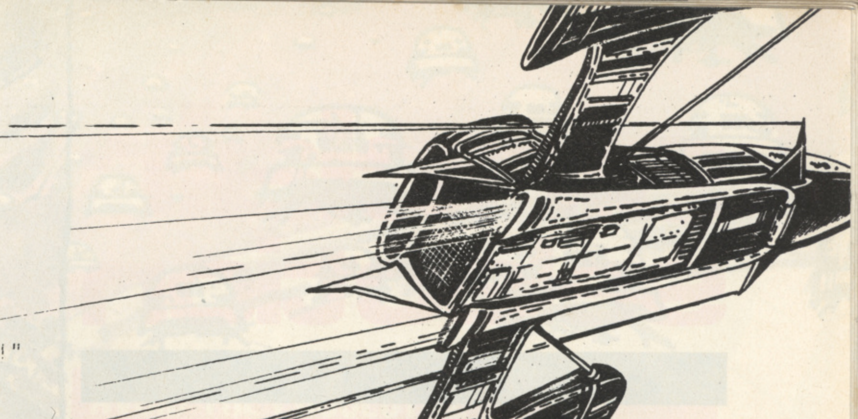

```
1190 IF CH=64 THEN CH=32:GOTO 1140
1200 NEXT:N=2:GOTO 1220
1210 REM - End Game
1220 GOSUB 1460
1230 SCREEN 16,3:PRINT"-- ATTACK  OVER --"
1240 IF N<>1 THEN 1270
1250 SCREEN 11,5
1260 PRINT"* Crashed into Buildings ! *"
1270 IF N<>2 THEN 1300
1280 SCREEN 9,5
1290 PRINT"Trapped by Gravity Force-Field !"
1300 RC=0:IF TC<100 THEN RC=1
1310 SCREEN 14+RC,7
1320 PRINT"You scored"TC"Points."
1330 IF TC<TS THEN 1370
1340 TS=TC
1350 SCREEN 4,9:PRINT"This is the Highest ";
1360 PRINT"recorded score so far!":GOTO 1390
1370 SCREEN 8,9:PRINT"The Highest recorded ";
1380 PRINT"score is"TS
1390 SCREEN14,13:PRINT"Another Game (Y or N) ?"
1400 A=USR(0):IF A=0 THEN 1400
1410 IF A=89 THEN 1960
1420 IF A=78 THEN 1440
1430 GOTO 1400
1440 CLS:PRINT"Hope you enjoyed the Game!"
1450 END
1460 REM - Claer 15 Line Screen
1470 FOR I=1 TO 15:SCREEN 1,I
1480 PRINT CHR$(27):NEXT
1490 RETURN
1500 REM - Pause For Key Press
1510 SCREEN 11,14
1520 PRINT"* Hit any key to continue *"
1530 FOR I=1 TO 500
1540 A=USR(0):IF A<>0 THEN RETURN
1550 NEXT
1560 SCREEN 11,14:PRINT CHR$(27)
1570 FOR I=1 TO 200
1580 A=USR(0):IF A<>0 THEN RETURN
1590 NEXT
1600 GOTO 1510
1610 REM - Instructions
1620 GOSUB 1460:SCREEN 1,1
1630 PRINT" As you go speeding across the surfa
ce of an"
1640 PRINT"alien planet in your laser equipped
 anti grav."
1650 PRINT"air car the idea is to wreak as much
 havoc and"
1660 PRINT"destruction on the city below you as
 you can."
1670 PRINT" You steer your craft `\ /' by using
 the four"
1680 POKE 2338,170
1690 PRINT"cursor arrow keys ` ↑  ' and fire
 your laser"
1700 POKE 2397,13:POKE 2401,11:POKE 2403,9
1710 PRINT"gun by pressing the `SPACE-BAR'."
1720 PRINT" Your craft also has two selectable
speeds."
1730 PRINT"Press `1' for normal attack speed an
d `2' for"
1740 PRINT"super fast `Zype' drive."
1750 PRINT" Aim for the strategic targets ` ' a
nd ` ' to"
1760 POKE 2730,7:POKE 2738,14
1770 PRINT"score points (50-300)."
1780 GOSUB 1500:GOSUB 1460
1790 SCREEN 1,1
1800 PRINT" You have a limited fuel supply, but
 you can"
1810 PRINT"gain extra by aiming for the special
 fuel"
1820 PRINT"supply targets ` '. Your ship can ho
ld a maxi-"
1830 POKE 2202,186
1840 PRINT"mum of 10 units as shown on the fuel
 gauge ` '."
1850 POKE 2294,128
1860 PRINT" Your attack will end if you either
run out of"
1870 PRINT"fuel, or fail to avoid one of the on
-coming"
1880 PRINT"city buildings ` '.":POKE 2458,255
1890 PRINT" Also beware of the invisible super
gravity"
1900 PRINT"force fields, your indicators ` ' wi
ll light"
1910 POKE 2601,184
1920 PRINT"up ` ' when you are approaching one.
"
1930 POKE 2638,185
1940 SCREEN 16,12:PRINT"Happy Marauding !"
1950 GOSUB 1500
1960 GOSUB 1460
1970 REM - Start Messages & Set Up
1980 F=50:FL=10:CR=0:K=0:SC=0:TC=0
1990 POKE 3018,184:POKE 3036,184
2000 T$="Points          Fuel "
2010 FOR T=1 TO LEN(T$)
2020 POKE 3037+T,ASC(MID$(T$,T,1)):NEXT
2030 AZ=3055:FOR I=1 TO FL
2040 POKE AZ+I,128:NEXT:PZ=AZ+I
2050 SCREEN 15,5:PRINT"ATTACK Mode Selected"
2060 SCREEN 17,7:PRINT"All Systems GO !"
2070 FOR T=1 TO 1000:NEXT:RM=500:SCREEN 1,9
2080 FOR I=1 TO 9:PRINT TAB(22)"GO !"
2090 RM=RM/1.5:FOR T=1 TO RM:NEXT
2100 NEXT:GOTO 260
2110 REM - Copyright (C) 1982 Futura Software
Ok
```

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SKI!

Test your skills on the ski-slopes with this program which can be modified to give two other games.

The object is to steer a skier through as many slalom gates as possible. Press Q to turn left, P to turn right.

By changing a couple of lines slightly this game can be changed to "RACER" viz:—

Change these lines to the following.

100 IF W = 4 THEN PRINT TAB Q: "■XXXXXX■"
120 IF W = 4 THEN LET T = T+ 1
130 PRINT AT 3,M: "X"
170 IF T = 60 THEN STOP
180 IF W = 5 THEN LET W = 1

All other lines stay the same

By changing the "RACER" listing still further we get "WORMHOLE". Keep the worm in his hole.

10
40
60 IF X 50 THEN LET Q = Q + 1
70 IF X 50 THEN LET Q = Q − 1
100 PRINT TAB Q: "■XX■"
110
120
130 PRINT AT 10,M: "V"
170
180

All other lines the same.

I have used the overprinted X to represent a half-tone square, i.e. CHR$ 8.

BY DEREK FAIRLESS

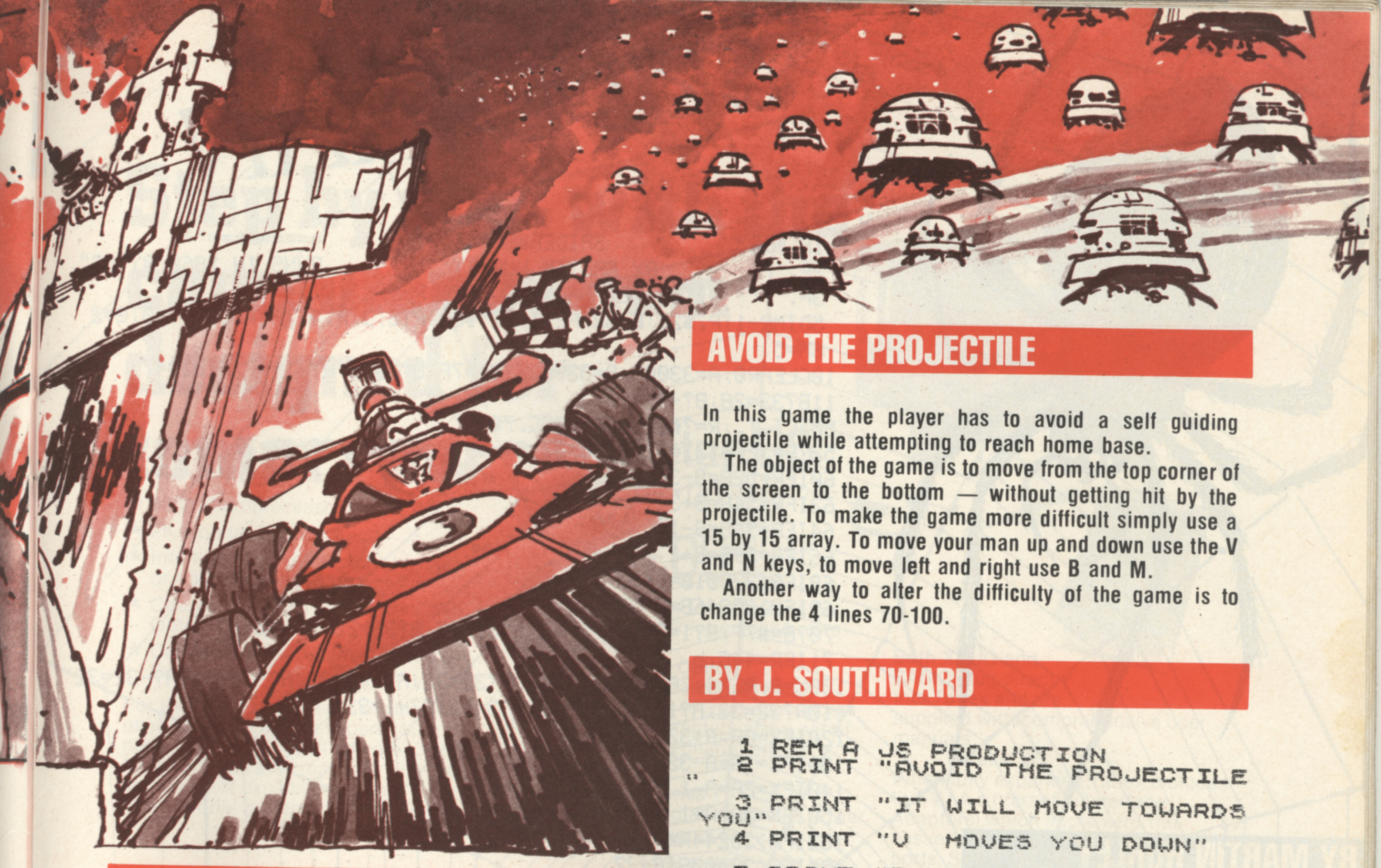
```
 10 LET W=1
 20 LET Q=10
 30 LET M=15
 40 LET T=1
 50 LET X=INT (RND/.01)
 60 IF X<50 THEN LET Q=Q+2
 70 IF X>50 THEN LET Q=Q-2
 80 IF Q=0 THEN LET Q=2
 90 IF Q=24 THEN LET Q=22
100 IF W=15 THEN PRINT TAB Q;"▒
";TAB Q+4;"▒"
110 LET W=W+1
120 IF W=16 THEN LET T=T+1
130 PRINT AT 10,M;""""
140 LET A$=INKEY$
150 IF A$="Q" THEN LET M=M-1
160 IF A$="P" THEN LET M=M+1
170 IF T=30 THEN STOP
180 IF W=16 THEN LET W=1
190 SCROLL
200 GOTO 50
```

EARTH Vs THE FLYING SAUCERS

An invasion fleet of flying saucers is swooping down on Earth and only you — the pilot of a jet fighter — stand in their way. The jet fighter appears on the left side of the screen and can be moved up and down using the keys 1. and A. The P key controls your air to air missiles.

BY D.E. HEALEY

```
 10 LET T=50
 20 LET A=PI/PI
 30 LET B=10
 40 LET C=PI-PI
 50 LET D=3
 60 LET F=4
 70 LET S=C
 80 GOTO 170
 90 PRINT AT B,D;" -"
100 LET D=D+A
110 IF B=F AND D=29 THEN GOTO 5
00
120 IF D<>30 THEN GOTO 90
130 LET D=3
140 CLS
150 IF T=C THEN GOTO 600
160 PRINT AT F,29;"<O>"
170 PRINT AT B,C;"▙▀▗"
180 IF INKEY$="1" THEN GOTO 220
190 IF INKEY$="A" THEN GOTO 300
200 IF INKEY$="P" THEN GOTO 90
210 IF INT (RND*4)=3 THEN GOTO
400
215 GOTO 140
220 LET B=B-A
230 IF B<C THEN LET B=C
240 GOTO 140
300 LET B=B+A
310 GOTO 140
400 LET F=INT (RND*15)
410 LET T=T-A
420 GOTO 140
500 LET S=S+A
510 PRINT AT F,28;"BOOM"
520 PAUSE 30
530 GOTO 400
600 CLS
610 PRINT S;" FLYING SAUCERS DE
STROYED"
```



GRAND PRIX

Take to the race track in this game of driving skill. The program simulates a track with randomly placed obstacles. Unfortunately due to the limited memory nothing happens if the player crashes into one of these, so a mental note should be taken of the number of obstacles hit and an extra five points added at the end for each collision.

When you have successfully completed the course the game ends and the time you took to cover the distance is shown.

The car accelerates when key six is pressed and is steered by using keys five and eight.

BY JEREMY YOUNGMAN

```
   5 REM WRITTEN BY J.S.YOUNGMAN
  10 LET A=0
  20 LET B=5
  30 LET T=0
  40 LET R=INT (RND*6)+2
  50 SCROLL
  60 PRINT "██████████"
  70 PRINT AT 21,R;"███"
  80 LET B=B+(INKEY$="8")-(INKEY
$="5")
  90 LET A=A+(INKEY$="6")
 100 PRINT AT A,B;"█"
 110 IF B<1 OR B>8 THEN GOTO 150
 120 IF A=21 THEN GOTO 170
 125 LET T=T+1
 130 IF INT (T/2)*2=T THEN GOTO
40
 140 GOTO 50
 150 PRINT AT A,2;"*BANG*"
 160 GOTO 180
 170 PRINT AT 21,1;"▘FINISH▚"
 180 PRINT AT 11,15;"TIME>";T
 190 PAUSE 32768
 195 CLS
 200 RUN
```

AVOID THE PROJECTILE

In this game the player has to avoid a self guiding projectile while attempting to reach home base.

The object of the game is to move from the top corner of the screen to the bottom — without getting hit by the projectile. To make the game more difficult simply use a 15 by 15 array. To move your man up and down use the V and N keys, to move left and right use B and M.

Another way to alter the difficulty of the game is to change the 4 lines 70-100.

BY J. SOUTHWARD

```
   1 REM A JS PRODUCTION
   2 PRINT "AVOID THE PROJECTILE
"
   3 PRINT "IT WILL MOVE TOWARDS
YOU"
   4 PRINT "V  MOVES YOU DOWN"
   5 PRINT "B MOVES YOU ACROSS"
   6 PRINT "N,M ARE THE SAME ONL
Y BACKWARDS"
   7 PRINT "PRESS NEW LINE"
   8 INPUT D$
  10 CLS
  12 SLOW
  14 PRINT AT 15,15;"▒▒HOME▒▒"
  15 LET R=15
  17 LET T=15
  18 LET S=0
  20 LET X=1
  30 LET Y=1
  40 LET U$="▛▙▛"
  50 PRINT AT X,Y;U$
  55 LET D$=INKEY$
  57 PRINT AT R,T;" "
  60 PRINT AT X,Y;"   "
  70 IF D$="V" THEN LET X=X+4
  80 IF D$="B" THEN LET Y=Y+4
  90 IF D$="N" THEN LET X=X-4
 100 IF D$="M" THEN LET Y=Y-4
 103 IF Y>15 THEN LET Y=15
 104 IF X>15 THEN LET X=15
 105 IF Y<0 THEN LET Y=0
 106 IF X<0 THEN LET X=0
 110 IF Y+4<T THEN LET T=T-1
 120 IF Y+4>T THEN LET T=T+1
 130 IF X>R THEN LET R=R+1
 140 IF X<R THEN LET R=R-1
 150 IF X=R AND Y<=T AND Y+9>=T
THEN GOTO 500
 160 IF X=15 AND Y=15 THEN GOTO
1000
 200 PRINT AT R,T;"█"
 300 LET S=S+1
 400 GOTO 50
 500 CLS
 510 PRINT "BOOM"
 520 PAUSE 10
 530 CLS
 540 GOTO 2000
1000 CLS
1010 PRINT "YOU HAVE ESCAPED"
1020 LET S=S+5
2000 PRINT "YOUR SCORE IS ";S
```

ALL RUN IN 1K

SPIDERMAN

BY MARTIN HURLEY

RUNS ON AN ATOM IN 2K

SLOWLY the creeping horror crawls toward you. Its eight legs make soft shuffling sounds as it advances. Its many eyes gleam with malice as deadly venom drips from its slavering mandibles . . . Don't you just hate spiders!

Here's your chance to hit back at those nasty creatures. The idea of this game is to sneak up on a spider and stamp on it. But your man must not stay near a spider for too long. The creatures can send a stream of deadly venom at your man — killing him instantly if it strikes.

The game ends when you have killed 10 spiders — in which case your man will jump for joy — or when you have lost five men.

The keys which control the action are:
T to go up. V to go down. F to go left. G to go right. L to stamp.

The variables are:— A: position of spider. B: position of man. M: amount of men. T: spiders killed. R: key pressed.

Illustration: Dorian Cross

```
>LIST
   1P.$12"            SPIDERMAN"'"            =========="'
   2P.'"        BY MARTIN HURLEY"''"          RUNS IN 1860 BYTES"
   3P.''" HIT A KEY WHEN YOU ARE READY";LI.#FFE3
   5DIMP-1;P.$21;[JSR#FE71;STY#80;RTS;];P.$6;P=#B002;T=0;@=2
   6M=5
  10CLEAR0;A=33003;B=32801;?B=#7F;B?1=28;B?-1=47;B?31=47
  11B?33=28;B?-32=15
  50aLI.T.;R=?#80;IFR=255G.70
  52?B=32;B?31=32;B?33=32;B?-1=32;B?1=32;B?-32=32
  60IFR=52B=B-32
  62IFR=54B=B+32
  64IFR=38B=B-1
  66IFR=39B=B+1
  68IFB<32801B=B+32
  69IFB>33246B=B-32
  70?B=#7F;B?1=28;B?-1=47;B?31=47;B?33=28;B?-32=15
  71IFR=44G.b
 100X=A.R.%4;?A=32;A?31=32;A?33=32;A?-31=32;A?-33=32;A?-32=32
 110A?32=32;A?1=32;A?2=32;A?3=32;A?-1=32
 120IFX=0A=A+32
 130IFX=1A=A-32
 140IFX=2A=A-1
 150IFX=3A=A+1
 152IFA>33244A=A-32
 154IFA<32800A=A+32
 160?A=#FF;A?31=47;A?33=28;A?-31=47;A?-33=28;A?-32=33;A?-1=48
 165A?32=33;A?1=45;A?2=45;A?3=45
 200IFR.%6=2G.c
 900G.a
2000bIFB+33=A ORB+31=A;G.2050
2005B?31=32;B?33=32;B?-1=24;B?1=24;P.$30;?#E1=0;P."YOU MISSED!"
2010F.K=1TO35;?P=?P:4;N.;B?31=47;B?33=47;CLEAR0;G.100
2050P.$30;?#E1=0;P."YOU HAVE KILLED"T+1" SPIDERS"
2080F.U=1TO5;B?-1=32;B?1=32;B?-31=47;B?-33=28;P.$7$7
2090B?-1=47;B?1=28;B?-31=32;B?-33=32;P.$7$7;N.;T=T+1
2100IFT=10P.$30"YOU HAVE KILLED THEM ALL!!";G.f
2110G.10
3000cO=A.R.%4+1;G.(O*10+3000)
3010O=64;F.N=0TO3;A?O=#2A;GOS.e;A?O=32
3011IFA?(O+32)<>32 ANDA?(O+32)=64G.d
3012O=O+32;N.;G.a
3020O=-64;F.N=0TO3;A?O=#2A;GOS.e;A?O=32
3021IFA?(O-32)<>32 ANDA?(O-32)<>64G.d
3022O=O-32;N.;G.a
3030O=-2;F.N=0TO3;A?O=#2A;GOS.e;A?O=32
3031IFA?(O-3)<>32 ANDA?(O-3)<>64G.d
3032O=O-1;N.;G.a
3040O=4;F.N=0TO3;A?O=#2A;GOS.e;A?O=32
3041IFA?(O+2)<>32 ANDA?(O+2)<>64G.d
3042O=O+1;N.;G.a
4000dM=M-1;P.$30"YOU LET HIM KILL YOU!!"'"YOU HAVE"M" MEN LEFT"
4005B?31=32;B?30=32;B?1=32;B?33=32;B?-31=32;B?1=#6A
4010?B=#7F;B?-1=48;B?-32=47;B?-30=47;F.K=0TO600;?P=?P:4;N.
4020IFM=0;P.$12"ALL YOUR MEN ARE DEAD";G.f
4030G.10
5000eF.H=0TO20;?P=?P:4;N.;R.
6000fP.''"DO YOU WANT ANOTHER GAME(Y OR N)";IN.W;IFW=Y;G.5
6010E.
```

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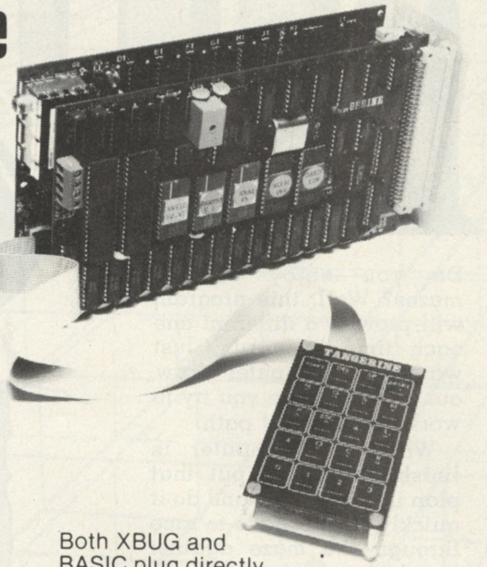

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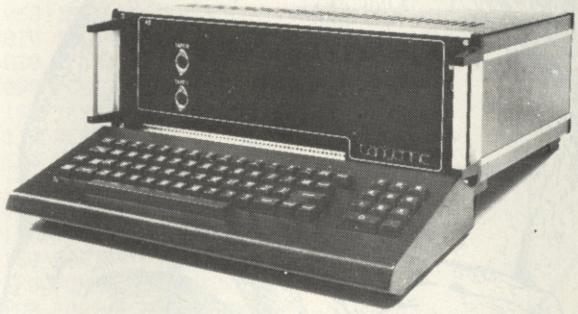

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When fully expanded Tanex includes two V.I.A.s (Versatile Interface Adaptors) which implement the cassette interface and the parallel I/O ports. Software in TANBUG V2.3 enables you to plug in and use a Centronics type printer. The two V.I.A.s also contain counter timers that can be used for a variety of applications enhanced by the use of the integral handshake facilities.

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MINOTAUR

Illustration: Dorian Cross

Do you enjoy solving mazes? Well, this program will provide a different one each time it is run. Just watch the computer draw out a maze while you try to work out the right path.

When the computer is finished drawing put that plan into action — and do it quickly as you have to race through the maze against the clock.

The program is built on algorithm, which will produce a maze which has one, and only one, path from a cell — the little "rooms" which make up the maze — to another cell.

The algorithm is as follows:

1. Fill the maze with little cells, no one connected to any other. (lines 40-80 in the program)
2. Choose one of them and call it the "mother cell" (line 95). It will be the "present position".
3. Record cells which aren't connected to any other cell and border on the present position (lines 100-140).
4. If there are no such cells, return to the previous position. If you can't do that, because you're in the mother cell, is the maze ready. (lines 150-160)
5. Choose randomly one of the recorded cells. (line 180)
6. Connect that cell to the present position, and record in that cell from where you connected it. (lines 190-220)
7. Move into that cell. (lines 230-260)
8. Go to step 3. (line 270)

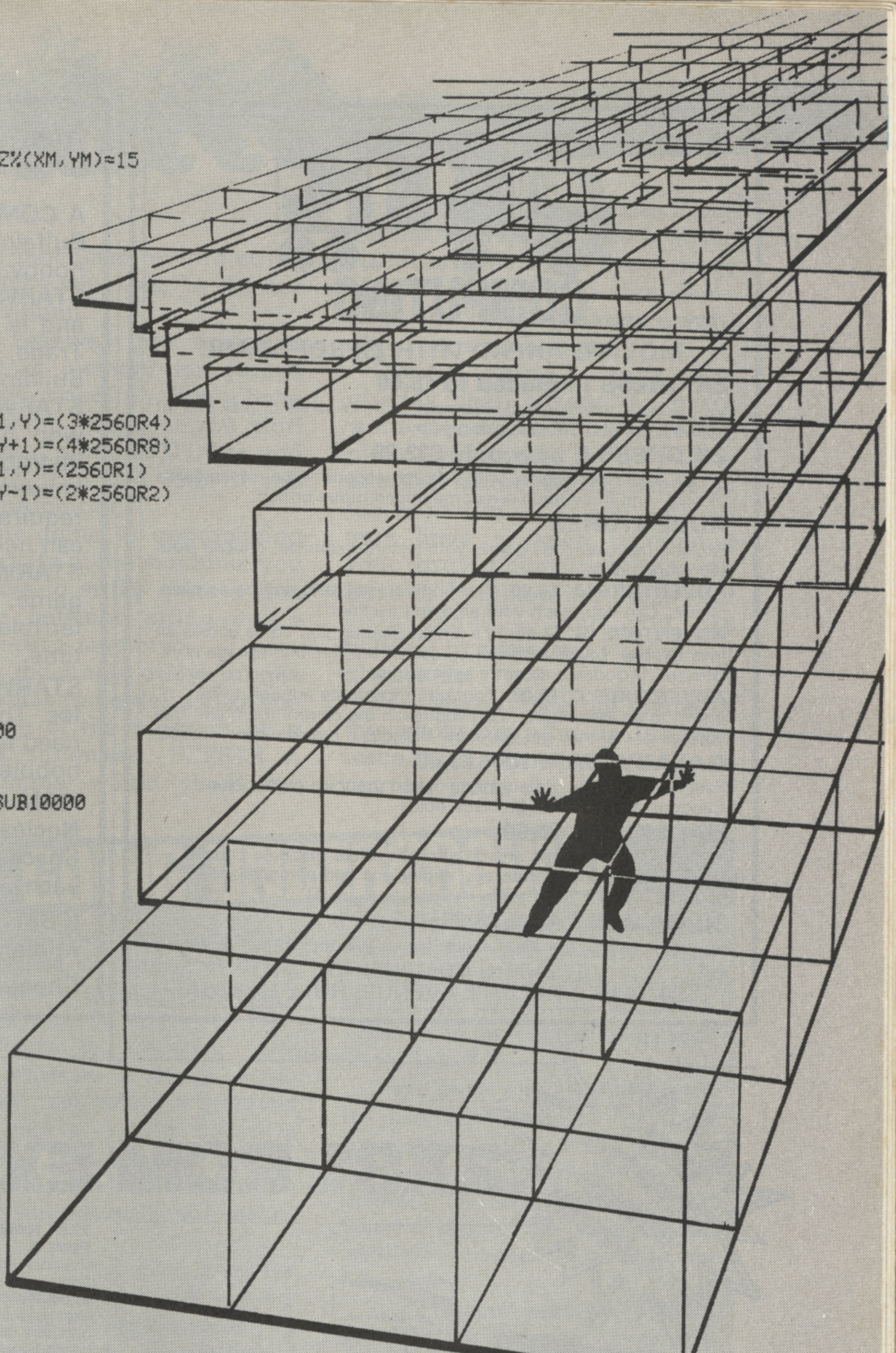
Lines 1-3 show the control keys and must be omitted to make the program fit in 3K.
Lines 12-30 initiates the screen (Poke 36879 selects the colour of the screen).
Lines 1000-1035 make the entrance and the exit of the maze and set the time.
Lines 1040-1100 are the race part of the program.
Lines 1110-1190 play a little tune when you have reached the exit.

BY MATS OEHRMAN

RUNS ON A VIC-20 IN 3·5K

```
1 REM"▓CRSR DOWN  ▓CRSR UP  ▓CRSR LEFT  ▓CRSR RIGHT"
2 REM"▓HOME  ▓CLR  ▓INST  ▓DEL"
3 REM"▓BLK ▓WHT ▓RED ▓CYN ▓PUR ▓GRN ▓BLU ▓YEL ▓RVS ON ▓RVS OFF"
5 REM "▓▓▓▓▓▓▓▓┌──────────────────┐
10 REM "▓▓▓▓▓▓▓▓▓▓   MINOTAUR (C) 1982 |   MATS  OEHRMAN   └──────
──┘
12 PRINTCHR$(142)"▓▓";
14 POKE36879,25
15 INPUT "INSTRUCTIONS";A$:IFLEFT$(A$+"Y",1)<>"N"THEN GOSUB5000
20 POKE36879,93
30 PRINT"▓"
40 XM=22:YM=21
50 DIMMZ%(XM,YM),U%(3)
55 FORL=38400TO38905:POKEL,7:NEXTL
60 FORL=1TO20:MZ%(0,L)=10:MZ%(XM,L)=10:NEXT L
70 FORL=1TO21:MZ%(L,0)=5:MZ%(L,YM)=5:NEXT L
```

```
80 MZ%(0,0)=15:MZ%(0,YM)=15:MZ%(XM,0)=15:MZ%(XM,YM)=15
95 X=10:Y=10
100 A=0
110 IF MZ%(X-1,Y)=0 THEN U%(A)=1:A=A+1
120 IFMZ%(X,Y-1)=0THENU%(A)=4:A=A+1
130 IFMZ%(X,Y+1)=0THENU%(A)=2:A=A+1
140 IFMZ%(X+1,Y)=0THENU%(A)=3:A=A+1
150 IFA=0ANDX=10ANDY=10THEN1000
160 IFA=0THENR=INT(MZ%(X,Y)/256):GOTO230
170 B=INT(RND(1)*(A+1)):IFB>=ATHEN170
180 R=U%(B)
190 IFR=1THENMZ%(X,Y)=(MZ%(X,Y)OR1):MZ%(X-1,Y)=(3*256OR4)
200 IFR=2THENMZ%(X,Y)=(MZ%(X,Y)OR2):MZ%(X,Y+1)=(4*256OR8)
210 IFR=3THENMZ%(X,Y)=(MZ%(X,Y)OR4):MZ%(X+1,Y)=(256OR1)
220 IFR=4THENMZ%(X,Y)=(MZ%(X,Y)OR8):MZ%(X,Y-1)=(2*256OR2)
225 GOSUB10000
226 POKE38400+22*X+Y,7
230 IFR=1THENX=X-1
240 IFR=2THENY=Y+1
250 IFR=3THENX=X+1
260 IFR=4THENY=Y-1
265 GOSUB10000
266 POKE38400+22*X+Y,2
270 GOTO100
1000 X=1:Y=1:MZ%(1,1)=MZ%(1,1)OR8:GOSUB10000
1010 X=1:Y=0:MZ%(1,0)=2:GOSUB10000
1015 X=1:Y=0:MZ%(1,0)=2:GOSUB10000
1020 X=21:Y=20:MZ%(21,20)=MZ%(21,20)OR2:GOSUB10000
1025 X=21:Y=21:MZ%(21,21)=8:GOSUB10000
1030 X=1:Y=0
1035 TI$="000000"
1040 GETA$
1045 PRINT"▓▓"INT(TI/6)/10
1046 POKE38400+22*X+Y,4
1050 IF A$="J"AND(MZ%(X,Y)AND1)<>0THENX=X-1
1060 IFA$="N"AND(MZ%(X,Y)AND8)<>0THENY=Y-1
1070 IFA$="M"AND(MZ%(X,Y)AND2)<>0THENY=Y+1
1080 IF A$=" "AND(MZ%(X,Y)AND4)<>0THENX=X+1
1090 POKE 38400+22*X+Y,3
1100 IFX<>22ANDY<>21THEN1040
1110 RESTORE
1120 POKE36878,15
1130 FORL=0TO24
1140 READP,Q
1150 POKE36875,P:POKE36876,P
1160 FORT=0TO30*Q:NEXTT
1170 POKE36875,0:POKE36876,0
1180 FORT=0TO10*Q:NEXTT
1190 NEXTL
1200 PRINT"▓▓▓▓▓▓▓▓▓PRESS <RETURN>";
1210 GETA$:IFA$<>CHR$(13)THEN1210
1220 RUN
5000 PRINT"▓▓▓▓▓▓INSTRUCTIONS:▓▓▓▓▓▓"
5010 PRINT"◣THIS PROGRAM DRAWS A  MAZE."
5020 PRINT"▓YOU'RE TO MOVE ACROSS IT IN THE SHORTEST    POSSIBLE TIME."
5030 PRINT"▓WHEN THE MAZE IS READY(TOTALLY RED) DO YOU  GUIDE THE LITTLE LIGHT";
5040 PRINT"SQUARE WITH:  ■▓J■"
5050 PRINT"                 ▓N■ ▓M■"
5060 PRINT"               ▓<SPACE>■"
5070 PRINT"▓◣THE START IS IN UPPER LEFT CORNER, THE FIN- ISH IN THE LOWER RIGHTO
NE."
5080 PRINT"▓▓▓PRESS <RETURN>■"
5090 GETA$:IFA$<>CHR$(13)THEN5090
5100 RETURN
10000 IF((MZ%(X,Y)AND1)<>0)AND((MZ%(X,Y)AND8)<>0)THENP=32+128:GOTO10040
10010 IF((MZ%(X,Y)AND1)<>0)THENP=101+128:GOTO10040
10020 IF((MZ%(X,Y)AND8)<>0)THENP=99+128:GOTO10040
10030 P=79+128
10040 POKE7680+22*X+Y,P
10050 RETURN
20000 DATA 187,4,187,4,201,2,201,4,201,2,195,2,195,2,183,2,163,2,175,6,163,1,175
,1
20010 DATA 183,2,195,2,195,2,201,2,195,2,183,2,163,3,175,1,183,2,183,2,175,2,175
,2,163,6
```



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FROM TOP TO BOTTOM

Those of you who have ventured into the dark forest of Adventure programming and typed "LOOK AROUND" probably can't see the wood for the trees by now! So let's have a look at the structure of a complete program.

From top to bottom of the program, the following sequence shows how various blocks of code fit together.

1. This block of code lays out the ground for the program to operate in:
   CLEAR string space. (Allows manipulation of character strings)
   DEFINE variable types. (string, integer etc.)
   DIMENSION arrays.
2. This block loads the framework of the plot READ in DATA or directly assign variables — or both.
3. Start of program loop. Communicate with the player:
   Check for special conditions.
   Clear screen.
   PRINT display variables.
   Reset screen variables to null.
   Await INPUT.
4. Interpret the player's communication with the computer: Decode verb and noun.
   IF either are invalid singly or in combination set reply and return to block three.
   ELSE GOTO block five.
5. Execute the plot:
   This block comprises a number of routines, one to cover each valid verb. Each routine alters game variables and sets reply variables, then returns to block three or goes to block six, for a standard reply.
6. Set standard replies. For example "IMPOSSIBLE" "OK".
7. DATA statements to be read by block two.

Let's have a look at block one in some detail. Don't worry if your computer doesn't have all of these Basic statements — but use them if it does!

Some machines require string space to be set aside, by the use of Clear nnnn.

This reserves the specified amount of memory for strings and string handling. If you have this feature I suggest you start by clearing about 1500 bytes and adjust by trial and error if you start running out.

If your game is approaching the capacity of the machine, you may have to strike quite a fine balance between string space and run-time memory.

Some machines allow ranges of variables to be defined at the beginning of the program by a DEFSTR statement. DEFSTR A for example would thereafter cause any variable whose name begins with an A to be a string variable. This saves the memory requirement for the $ sign. Similarly, DEFINT will define a variable range as integer.

Dimensioning arrays has already been covered — but a word of advice! Make sure the plot of your game is thoroughly detailed before setting hands on the keyboard — or you will not only have to keep increasing your array dimensions, you will have to lengthen the loops that scan them — and you are BOUND to miss one! I know — I always do!

Now we can see the shape of the whole program, in the next issue I will start to examine more detailed parts of its logic.

GOING UNDERGROUND

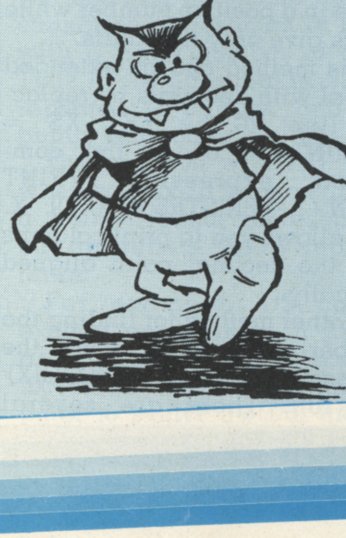
I have been playing Abersoft Adventure supplied by Abersoft of Dyfed, which runs on a Sinclair ZX81 with 16K RAM pack.

"Welcome to Adventure" proclaims a flicker-free screen on typing "RUN", and before long we are on the edge of a forest outside a large brick building.

Further exploration leads us to a canyon, and eventually to a locked grating.

Oh dear — you didn't bring the keys, did you? Never mind — I did, so down the grating we go only to find ourselves in an underground world of caverns, low twisting passages, and a vast chamber with an uncrossable fissure.

We have collected en route a small bird, a wicker case, and a black rod. Hang about — we've done this before haven't we?



Yes, for all intents and purposes we could be inside a Pyramid of the Tandy variety. For black rod read sceptre, for small bird read bird-statue and for wicker cage read statue box.

Those of us who are well travelled now know how to cross the fissure, find torch batteries etc.

What I didn't mention when I received the Tandy game is that Pyramid is itself an abridged and modified version of the original Adventure.

So for sceptre read wand. Could be useful for there are things you would expect to do with a wand but not necessarily with a sceptre or rod.

Although not an original plot, it has certainly survived well! What's it like on a Sinclair? I found it — typing apart — better than on a Tandy as the screen is cleared rather than scrolled, making it, for me anyway, less confusing.

One small criticism is that the inventory is retained when the game is re-run. Consequently you can grab things, quit, and then cheat! Nevertheless, it is pleasing to see full size Adventures — in micro terms — being made available to thousands of Sinclair owners.

My thanks to Mrs. Pam Bryan of Southlands School, New Romney, for the loan of her computer for this review.

By KEITH CAMPBELL

PRACTICAL PROGRAMMING

GRAPHIC GRAPHS...

Many home computers have a sophisticated set of graphics commands, and various dialects of BASIC provide features for the format of output, including cursor control characters and such commands as PRINT USING, PRINT AT, etc. However, it is possible to do a great deal with only the standard formatting features of comma and semicolon following the PRINT statement, and the TAB function.

Using the TAB function it is possible to draw low resolution graphs; for example.:

```
100 FOR X = -1 TO 1 STEP
    1/10
110 LET Y = X*X
120 PRINT TAB (Y*40); "*"
130 NEXT X
```

will give a graph of the function $Y = X^2$ from $X = -1$ to $X = 1$; while

```
100 FOR X = 0 TO 2 STEP
    1/10
110 LET Y = X³
120 PRINT TAB (Y*5); "*"
130 NEXT X
```

will give a graph of the function $Y = X^3$ from $X = 0$ to $X = 2$

The reason for using Y*40 and Y*5 is to provide a suitable scale for the graphs. The argument of the TAB function is required to be not greater than the number of columns on the screen; since $X^2 <= 1$ when X is between −1 and 1, and $X^3 <= 8$ when X is between 0 and 2, these values allow us to use the full width of a 40 column screen.

It is also possible to draw a graph of a function which takes negative values; for example, Y = SIN(X):

```
100 LET L = 2*3.14159
110 FOR X = 0 TO L STEP 1/50
120 LET Y = SIN(X)
130 PRINT TAB (20 + 20*Y);
    "*"
140 NEXT X
```

Negative values will appear on the left of the screen and positive values on the right.

The most straight-forward use of the comma and semicolon in PRINT statements is to produce columns of numbers, but there are problems when different numbers of digits are involved. For example:

```
100 FOR I = 1 TO 10
110 PRINT I; I*I; I*I*I
120 NEXT I
```

will give the result shown in table one, while replacing the semicolons with commas gives the slightly better, but still unsatisfactory table two.

We can use the TAB function to print the columns with the numbers right-justified; we need TAB(N) for one-digit numbers, TAB(N−1) for two-digit numbers, TAB(N−2) for three-digit numbers, etc. (i.e., we need TAB(N+1 − number of digits), which leaves only the problem of finding the number of digits in each number to be printed. There is no simple way to do this, but the method I prefer is the following:

```
10 LET X = number to be
   printed
20 LET X$ = STR$(X)
30 LET D = LEN(X$)
40 PRINT TAB(N+1−D); X
```

i.e. convert the number to a string and then find the length of the string. The various operations can be combined into a single statement, PRINT TAB(N+1−LEN(STR$(X))); X

STRINGS AND THINGS...

One point that you need to watch when using STR$ is the format of the resulting string. Some BASICs give a leading space in a positive number while others give only the digits.

This method can be extended to deal with decimals by replacing line 20 by LET X$ = STR$(INT(X)), or in the compacted expression PRINT TAB(N+1−LEN(STR$(INT(X)))); X. This allows you to print columns with the decimal point aligned vertically.

Another method for finding the number of digits is to use the expression D = 1 + INT(LOG(X)/LOG(10)). There are several reasons why this is less satisfactory than using STR$ and LEN, including its lack of obviousness and the practical reason that, due to rounding errors within the BASIC, it may give the wrong answer on numbers close to a power of 10.

COMPLICATED CALCULATIONS

A more complicated problem involving columns of numbers arises when we have amounts of money in pounds and pence which have to be printed with exactly two digits after the decimal point; e.g., £1.30 rather than £1.3 or £2.00 rather than £2.

If the amounts are calculated by a method which does not necessarily produce an exact number of pence the answers must first be rounded. The standard method for rounding to two decimal places is:

X = INT(100*X + .5)/100
(rounding to the nearest penny)
or X = INT(100*X)/100
(rounding to the lower penny)

When we have the answer correct to two decimal places we cannot simply print it using one of the methods above, as trailing zeroes after the decimal point will not be printed by BASIC, and the decimal point will not be printed if the answer is an integer. To get around this we have to do a great deal of manipulation, separating pounds and pence, converting to strings, removing leading spaces put in by STR$, making sure that there is always two digits in the pence, and finally putting everything back together.

```
100 LET X = amount in pounds,
    to 2 decimal places
 110 REM SEPARATE X INTO L
     POUNDS AND PENCE
 120 LET L = INT(X)
 130 LET P = 100*(X−L)
 140 REM CONVERT FROM
     NUMERIC TO STRING
     VARIABLES
 150 LET L$ = STR$(L)
 160 LET P$ = STR$(P)
 170 REM DELETE LEADING
```

BY TED BALL

```
    SPACES IF NECESSARY
180 IF LEFT$(L$,1) = "  "
    THEN LET L$ =
    RIGHT$(L$, LEN(L$)-1)
190 IF LEFT$(P$,1) = "  "
    THEN LET P$ =
    RIGHT$(P$,LEN(P$)-1)
200 REM ADD LEADING ZERO
    IF LESS THAN 10 PENCE
210 IF P<10 THEN P$ = "0" +
    P$
220 REM NOW BUILD UP
    FINAL STRING
230 LET A$ = "£" + L$ + "."
    + P$
240 REM PRINT ANSWER
    RIGHT-JUSTIFIED TO
    COLUMN N
250 PRINT
    TAB(N+1-LEN(A$)); A$
```

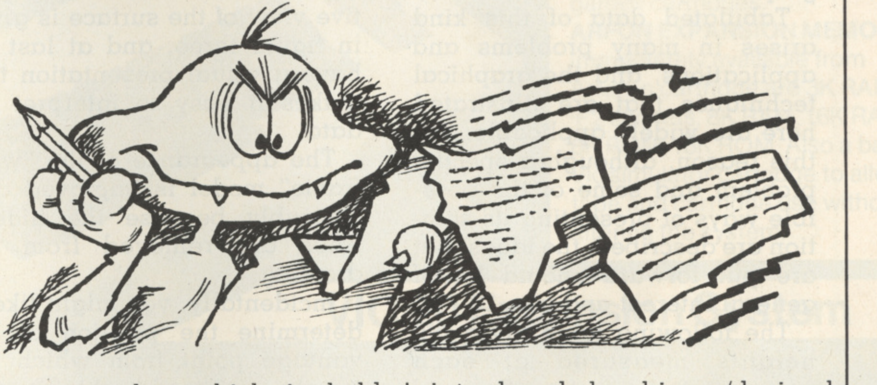
If you want to use the above routine in a program it can be cut down considerably by combining some of the statements, and either eliminating lines 180 and 190 or cutting them down to the part after "THEN", depending on what is required in your machine. The form given here is intended to explain the method rather than to be used as it stands.

Table 1

1	1	1
2	4	8
3	9	27
4	16	64
5	25	125
6	36	216
7	49	343
8	64	512
9	81	729
10	100	1000

Table 2

1	1	1
2	4	8
3	9	27
4	16	64
5	25	125
6	36	216
7	49	343
8	64	512
9	81	729
10	100	1000



ROUNDING ERRORS

I mentioned rounding and rounding errors above, in passing, but this is a subject that deserves a closer examination. Many of the numbers we deal with are approximate, particularly numbers obtained by measurement, and we often have to round answers to a specified number of decimal places or a specified number of significant figures.

There is a simple method for rounding to any specified number of decimal places, as described above for the case of two decimal places, and the same method can also be used to round to any required degree of accuracy.

However, when using the INT function we must always watch out for differences between the decimal number that the computer prints on the screen and the binary number which is held internally and used in calculations. Just as some fractions do not have a decimal representation in a finite number of digits, we also find that some fractions cannot be represented in binary with a finite number of digits. Thus 1/3 as a decimal is .3333 ... repeated to infinity, and as a binary fraction is .010101...

The problem with INT arises when we have a fraction that has a finite decimal representation but an infinite binary representation.

For example, 1/5 can be exactly represented in decimal as 0.2, but in binary is .00110011.... If we ask the computer to PRINT 5∗(1/5) the answer will come out as 1, as we expect, but internally the answer may be binary fraction .1111... to 24 or 32 places. The result of PRINT INT(5∗(1/5)) would be 0 since the binary fraction is less than 1.

FINDING THE ANSWER . . .

In order to be sure that we get the right answer we must add a small fraction to the computer's answer, for example, when rounding an amount of money to the lower penny, if we use:

LET X = INT(100∗X)/100

due to binary decimal conversion, 100∗X may be 2^{-24} or 2^{-32} less than an integer and INT(100∗X) would be one less than the correct amount.

If we do the rounding by:

LET X = INT(100 X + .0001)/100

we correct for the small error introduced by binary/decimal conversion, although adding .0001 may sometimes introduce an error in the opposite direction.

A similar problem arises when making tests for equality. As in the example above, we may find that a number printed out as an integer is actually held internally as a fraction differing by a small amount from an integer.

The test IF X = 1 THEN . . . may give the wrong result although PRINT X would give the answer 1. This can be allowed for by testing for the two numbers being close together rather than for them being equal, so we should write instead IF ABS(X−1) <1E−6 THEN...

ADVENTURE IN VIEW

Creators of Adventure games have yet to tap the full potential of graphics.

They can be used to model terrains which could be a big advantage in such games. The terrain can provide opportunities for ambush and give a clear advantage to characters occupying the heights. In general, graphics can provide many tactical possibilities.

An important use of graphics has always been to present information in such a way that it can be easily understood.

In this article we are going to start with a table of numerical data, and examine various ways of presenting this information graphically.

Tabulated data of this kind arises in many problems and applications, and the graphical techniques that are illustrated here are widely applicable. For this reason, although a specific problem and some of the possible ways of presenting its solution are described, the ideas that are put forward should be of general interest and use.

The following table gives the heights measured at each cross-point of a rectangular grid covering a particular site.

ROW \ COLUMN	1	2	3	4	5	6	7	8
1	1.2	1.0	0.8	0.6	0.6	0.4	0.2	0.2
2	2.1	1.8	1.5	1.6	2.2	1.9	1.0	0.8
3	2.8	2.8	2.8	3.4	4.3	3.8	2.6	2.3
4	3.3	3.5	4.2	5.8	8.2	9.2	6.3	3.4
5	3.9	4.2	4.6	5.5	5.6	5.3	4.5	4.0
6	5.1	5.3	5.9	5.7	5.8	5.5	4.9	4.6
7	6.0	6.1	6.8	6.2	6.0	5.8	5.5	5.4
8	6.1	6.2	6.4	6.6	6.2	6.2	5.7	5.6

The data could have come from an official survey or from measurements made in my garden. They could be used to model the terrain that was surveyed, but the data could equally well be used to provide the field of operations for an Adventure game.

The information in the table can be presented in the way shown in figure one by drawing a curve using the data in each row of the table. Each curve gives a different cross-section of the surveyed region. This presentation is rather cluttered and does not really help one to visualise the appearance of the site.

Figure two shows the information presented as a contour map. This is a rather better presentation. It could be enhanced by using colours to shade the regions between contours as is done in the maps in an atlas.

However, it still does not give a visual impression of the appearance of the region. Its effectiveness depends almost entirely on whether the observer is familiar with the idea of a contour map.

A three-dimensional perspective view of the surface is given in figure three, and at last we have a visual presentation that makes it easy to interpret the data.

The appearance of the "wireframe" model is improved considerably because the hidden lines are removed from the drawing.

Incidentally, you might like to determine the position of the vantage point from which the terrain is viewed in this figure.

The three-dimensional contour map of the region shown in figure four also provides a good visual impression of the surface of the region.

An ideal presentation of the data might consist of a combination of methods. Using both a three-dimensional perspective and a contour map, the details that are not apparent because of hidden line removal in the 3D presentation can be deduced from the contour map. Alternatively, a series of three-dimensional perspective from different viewpoints may prove to be most useful.

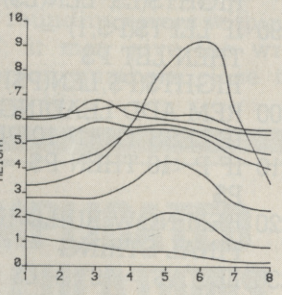


FIGURE 1

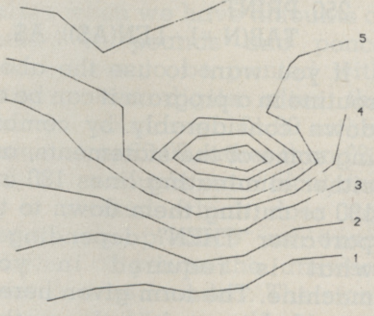


FIGURE 2

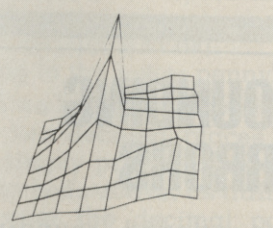


FIGURE 3

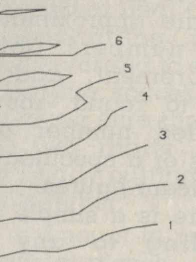


FIGURE 4

By Gary Marshall

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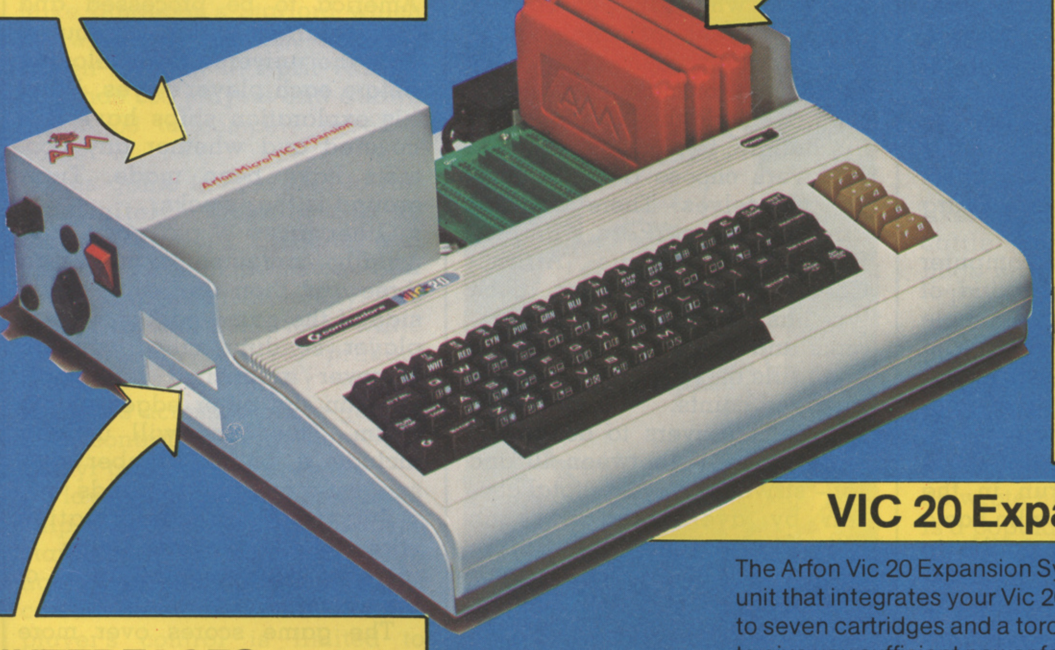

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Play-by-mail computer games are already big business in the U.S. and look ripe to take off over here.

Terry Pratt reports

The name of Ragnar the pirate and his star troopers must now be feared in this sector of the galaxy. Nine enemy worlds have I plundered in the last parsec-four of these for the first time.

The invasion of Sirain's empire is going strongly. She puts up so little resistance that I will pull out half of the attacking force to plan an assault elsewhere.

My tame merchant Epplan is transferring materials as fast as his fleet can and I know he needs the business so he is no threat for the moment.

Chaos the Berserker and his many robots have proved faithful allies throughout the game ... which makes them a perfect target! And as Chaos must be thinking the same, I'll attack him now. And I wonder who ambushed those two explorer ships I sent out...?

The late night caller identifies himself: "This is Space Pirate Tharg. Unless you start delivering raw materials to me as from the next turn I'm going to plunder your home world."

He hangs up abruptly, leaving you to wonder; Can Tharg really be serious? How does he expect me to react? Was it even Tharg at all?

Hard to imagine a computer being involved in this kind of duplicity but this is an example of the kind of play you have to guard against in the still relatively undiscovered field of computer moderated gaming.

The best established of these games is Starweb, run in the U.K. by Chris Harvey, who has a host of horror stories similar to the above: of murderous berserkers claiming to be merchants to dupe the unwary; of players tricked into forfeiting their next turn; and attackers who, in mid-onslaught, realise they have been fed the wrong map information.

Anything goes and you have to be prepared to face opponents who will stop just this side of the law-of-the-land to achieve their ends. Threats, broken alliances, libel, lies and downright sneakiness, form the fabric of these games, some of which consider 18 months a good life span — others go on indefinitely.

A computer program is used to map out a world, galaxy or even universe and the rules and aims of its races and inhabitants. The game is then peopled by players, who take charge of tribes, nations or whole solar systems and then plan their campaigns for mastery.

Starweb, via the U.S. firm, Flying Buffalo, is a good example.

Players choose a racial type for themselves. There are six: Pirates, Berserkers, Empire Builders, Merchants, Artifact Collectors, and Apostles. Each type has his own special powers, aims and victory conditions. As he fulfills these conditions, he is awarded points.

Enough players to achieve a good game — (between 10 and 15) – strive for a points total chosen by averaging out each player's suggested winning total.

Apostles try to convert worlds, Empire Builders attempt to own worlds, Berserkers aim to destroy life, Pirates seek to plunder planets, while the popular Merchants ship much-needed raw materials and Artifact Collectors hope to gather rarities.

It's a combination of characters which ensures plenty of rivalry and conflict but also demands interaction, reliance on other players and usually results in some unholy alliances.

The player is placed on his home worlds, given ships and forces as befits his role and embarks on his quest by sending off a letter detailing his orders.

In the case of Starweb these are sent to an old mainframe computer — a Raytheon — in America to be processed and then returned with a printout of how the universe is developing before each player's eyes. What his exploration ships have discovered and whether any contacts have been made. Turnaround is four weeks.

Other races — players — are usually contacted around turn three and then the "diploming" side of the game begins, with a player sending off a card to whoever ambushed his small fleet on the outer edges of his realm. This card will usually include a phone number and suggest a meeting of minds.

Swopping any information with fellow players helps to increase your understanding of the universe.

The game scores over more orthodox wargames, firstly because fellow enthusiasts are found for you and secondly, because there is a greater sense of realism. You can't see your opponent secretly massing his forces on your border and you don't know what is lurking beyond what you have explored.

You only have a player's word about his strength, race characteristics and intentions – so just how far do you trust a space pirate? According to enthusiast Kim Bailey, honesty is the best policy because those who lie are usually caught out and never trusted again.

WHO'D TAKE THE WORD OF A SPACE PIRATE?

Diploming is the most important part of the game. Being able to persuade others that it is in their interests to do what you want them to is the mark of a good player.

Occasionally you come across a player who will not talk and these, according to top player Bob Brown are the first to go: "They are an unknown quantity and that alone forces you to attack them."

It is difficult to estimate how many Starweb players there are in the U.K. as many play several games at once but it is in the region of 250+.

The U.K. end is run from P.O. Box 100, Bath Street, Walsall, West Midlands.

Starweb costs £1.50 per turn. Other Flying Buffalo games which have a following over here are: Nuclear Destruction, 50p; Battle Plan £1.00; and Space Battle, from 75p.

The only all-British game is Mike Singleton's Starlord which he wrote on his 32K Pet and began running in April 1981. It now has 300 players and allows up to 50 to compete in each game.

This game is designed to run indefinitely. Players aim to become Starlord Emperor and take their seat in the Throne Star at the centre of the Galaxy. The reward for this is free turns while Emperor, a complete printout map of the Empyr which stretches across a whole galaxy and control of any surviving Empyr garrisons.

Players start with a command ship, a base star and a fleet of 50 starships. The command ship has no fighting power but is a communications centre and the player's control is limited to seven astrals around this ship.

All the stars have a name and there are 14 types in this galaxy, including: signal stars, for galactic news; power stars, for fuel; gate and exit stars, for space jumps; city stars; battle stars and fort stars.

Battles are resolved by the computer, comparing each commander's battle orders, retreat threshold and ratio of forces on either side.

Starlord boasts a two weekly turnaround and costs £1.25 per turn. But the real measure of its success, is that America, the real home of this form of gaming, is keen to import Starlord under licence. Mike Singleton claims proudly: "We are negotiating with three American firms. It's a bit like selling coals to Newcastle." Mike is at 1 Rake Hey Close, Moreton, Wirrall, Merseyside.

Tribes of Crane is a computer assisted game with record storage and word processing performed by computer. This is set on the fantasy world of Crane and features the warring tribes of that nation.

Players take the part of a chief of one of the wandering tribes and their aim is to lead their people to dominance over the neighbouring tribes. Each tribe has its own way of measuring prosperity and so obtain points.

The game runs indefinitely and can be entered at any time and the fantasy world has a complete range of geography, ranging from desert to polar ice, with mountains, rivers and forests. Cities also form part of the world of Crane and act as centres of trade and homes for the land's powerful lords and shamans.

Among the creatures you are likely to run into are: caribou, cattle goats, warhawks and huge bipedal lizards.

The game is run in the U.K. by Mark Blundell and costs £6.50 for the first four turns. The price includes a rule book — players have to pay £1.50 per turn after that. Mark Blundell has two new games planned: Gladiator is one he wrote himself and Starmaster is a popular U.S. game. Both will be started this year. Write to him at Lothlorien, Stockdale, Heelands, Bucks.

Perhaps the best recommendation for computer moderated gaming is the players themselves. The four I telephoned came from very different parts of the country but — with one exception — they all either knew or had heard of one another by reputation. A very good way of contacting fellow games enthusiasts.

● If the idea of computer moderated games appeals to you, Starweb's U.K. agent is offering the chance to play it for free through the magazine. Turn to page 15 for further details.

Illustrations: Jon Davis

DOWN TO BASIC

SINCLAIR BASIC

The computer language BASIC fails to live up to its simple label in one major way. There is a variety of different versions of the language with each microcomputer manufacturer adding their own extras.

Unfortunately, this makes life difficult for the programmer transferring from one machine to another. To try and help you over this hurdle from now on, I will include a table summarising the main features of the version of BASIC available on one of the popular microcomputers. I start with the Sinclair ZX-81.

As I will continue to cover the general features of BASIC in parallel with the production of these tables, it is inevitable that they will include statements that I have not yet covered. You should use the tables for general reference.

Variables: Names of numeric variables may be of any length and consist of any combination of letters and digits provided they start with a letter. The name of a control variable in a FOR-NEXT loop must be a single letter. The name of a string variable must be a single letter followed by $.

Arrays: The name of an array must be a single letter followed by $ if it is a string array. Arrays may be of any size and any number of dimensions. For a string array the length of the strings must be specified in a DIM statement e.g. DIM N$(10, 5) sets up a list of 10 strings each of length 5. Substrings can be used e.g. (with above defined list) N$(2,1) refers to the 1st character in the 2nd string of list N$ N$(4, 3 TO 5) refers to characters 3-5 of the 4th string.

Statements: No END statement. The form of the IF statement is <line no.> IF <condition> THEN <statement>. CLEAR, deletes all variables. CLS, clears the display. FAST, increases speed of calculation, but affects the display. PAUSE, can introduce a pause in computing until a key is pressed or for a fixed time (if specified). POKE, writes specified value at specified memory address. SCROLL, scrolls the display up one line. SLOW, puts the computer in display mode.

Functions: ACS, arccosine. ASN, arcsine. CHR$, converts code number to character. CODE, converts character (first in specified string) to code no number. INKEY$, reads character pressed on keyboard. LN, natural logarithm. PEEK, value of byte in specified memory address address in range 0 to 65535. PI, value of Π. STR$, converts number to character string of digits. TAN, tangent. USR, calls machine code subroutine with specified start address. VAL, treats specified string as an arithmetic expression. Plus ABS, ATN, COS, EXP, INT, LEN, RND, SGN, SQR, SIN.

Graphics: Screen has 22 rows and 32 columns. PLOT X,Y "blacks-in" screen position row X, column Y. UNPLOT X,Y "blanks" screen position row X, column Y. Graphics characters.

NOT SO SIMPLE

As the programs that you write become more complex and longer, you will face two main problems.

You will find yourself having to repeat groups of instructions at several points in your program. These groups of instructions may be identical or very similar.

Another problem is that the increase in the length of your programs makes it more difficult for you to keep track of what is going on in your program.

The unfortunate consequences of this are that you will tend to make more mistakes in developing and typing in the program, and that the errors will be more difficult to track down.

The use of **SUBROUTINES** can help alleviate both these problems.

BASIC contains the facility whereby a sequence of instructions which is to be executed at several points in a program need only be written once. These instructions form a subroutine. Each time the subroutine is to be executed it may be entered by means of a **GOSUB** statement.

The general form of a GOSUB statement is

<statement no.> GOSUB
<statement>

for example:

20 GOSUB 400

As you can see, the form of the GOSUB statement is very similar to that of the GOTO statement. The operation of the GOSUB statement is in fact similar to that of the GOTO statement in that control will be transferred to the statement specified. In the above example, control will be transferred to statement 400.

However, with the GOSUB statement, a note is made of the current statement number before the specified jump takes place. It is then possible to return after the subroutine has been executed. With the GOTO statement, there is no record of where you jumped from.

In BASIC, a subroutine is actually no different from any other group of statements in a program except that there will be a **RETURN** statement at the end of the group. It is when this RETURN statement is encountered that the computer transfers to where the previous jump occurred.

The RETURN statement takes the form

<statement no.> RETURN

for example

BY MOIRA NORRIE

```
450 RETURN
```

After the return is made, the statement after the GOSUB statement will be executed.

Usually, subroutines are included at the end of a BASIC program. A program containing one subroutine could therefore take the general form

```
10 ____________
20 ____________
30 ____________
40 GOSUB 400
50 ____________
60 ____________
70 GOSUB 400
80 ____________
90 ____________
100 STOP
110 REM
400 REM***********
410 REM SUBROUTINE
420 REM
430 ____________
440 ____________
450 RETURN
460 REM***********
470 END
```

THE NEED FOR COMMENTS . . .

Two main points arise from the above example.

As stated previously, the only factors that distinguish a subroutine from any other section of code is that it has a RETURN statement at the end, and it has corresponding GOSUB statements. There is nothing in the mechanism for setting them up that clearly indicates the beginning of a subroutine and the task it performs. I have emphasised the need for comments in your program before. It is vital when using subroutines that, at the very least, you include a comment at the beginning of the subroutine.

In line 100 of the program there is a **STOP** statement. This causes the execution of the program to be stopped when it is reached. It is possible to have a number of STOP statements at various points in a program providing alternative stopping points.

SUBROUTINES AND LOGIC

The reason for the inclusion of a STOP statement in line 100 of the above example, is to prevent the computer automatically proceeding sequentially from statement 90 to statement 400 and through the subroutine. As a general rule, there should always be either a STOP statement or a GOTO statement immediately before a subroutine.

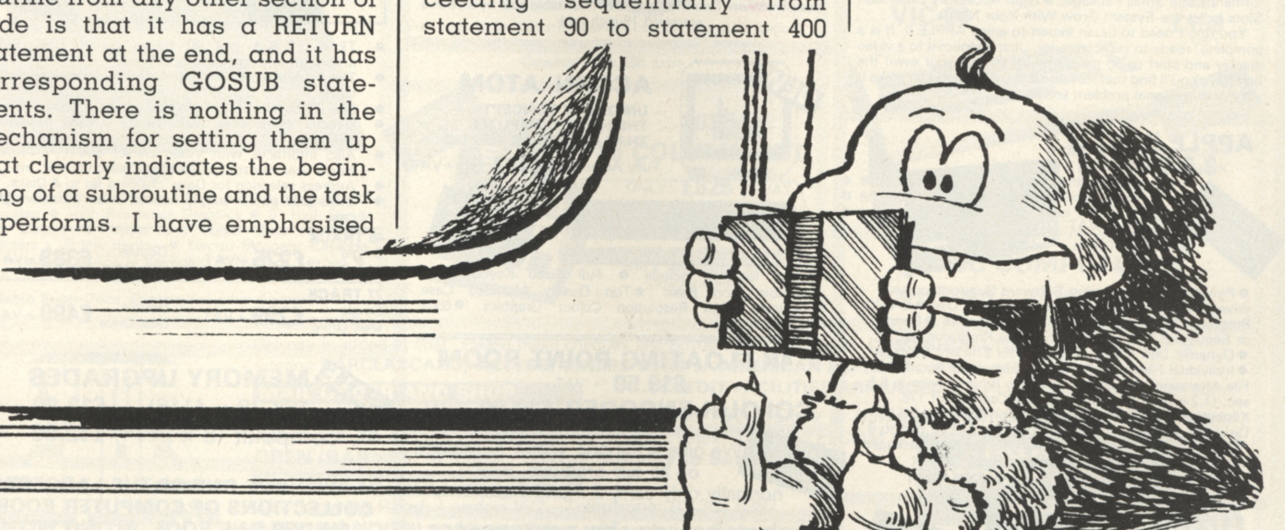
Subroutines are also used to split a program into logical sections — where each section can be developed and tested as a single unit. Ideally each logical section should be no longer than a page in length so that they remain easy to read and understand.

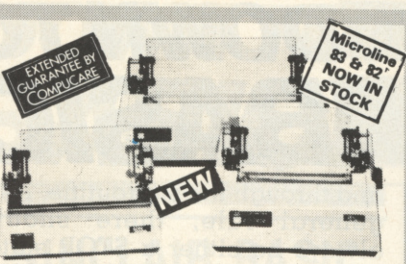
This may be achieved by further dividing large subroutines into logical sections some of which will themselves be subroutines. In this way, you can have nesting of subroutines.

NEXT MONTH

In a program, it is often necessary to process a list of related data items e.g. a list of individual golf scores. Next month, I will show you how to set up such a list and then process it. The microcomputer system to be covered is the Commodore PET.

NEXT MONTH

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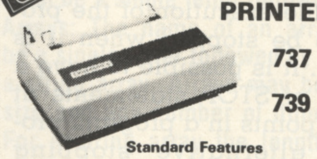

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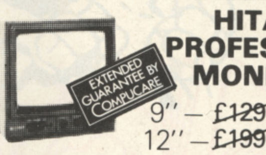

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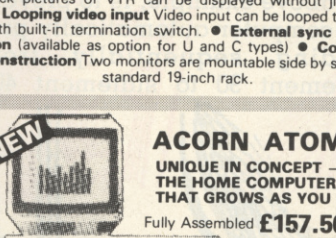

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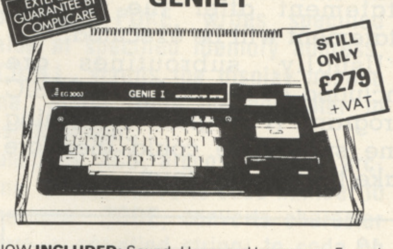

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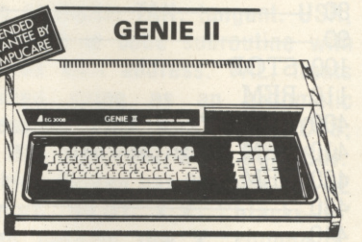

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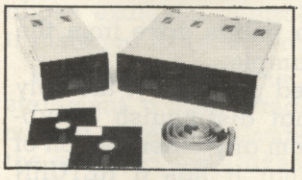

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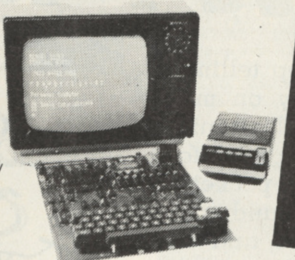

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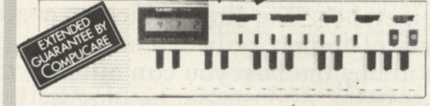

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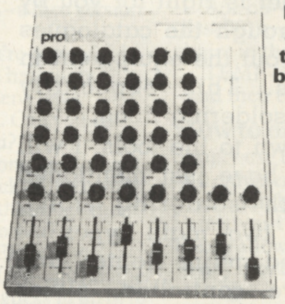

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SCREWDRIVERS AND SPANNERS

It would be nice, I keep telling myself, if I could carry on me every single piece of electronic equipment I was ever going to need. I tried once but my pockets split. Now all I carry around is a small neon screwdriver and a penknife, with which I can get most pieces of domestic equipment installed or temporarily repaired.

Of course, for construction, as well as for the majority of repair jobs you will need quite a few more pieces of equipment — and these I will cover here.

Before I start there are a number of important points to remember. The first, which is a rule of thumb I always employ, is to buy the best you can afford. Secondly, and almost as important, don't waste money buying something you will not use or which you could do without.

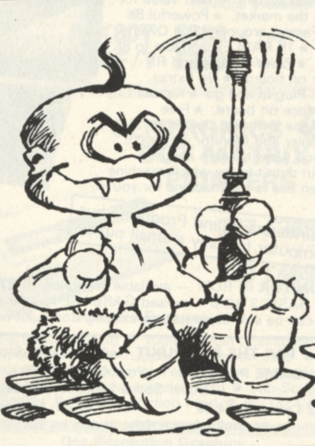
The last point is to find out which model is right for you by reading through the catalogues and trying out the equipment in the shops. This especially applies to soldering irons.

Now, down to the tools. I will start, as I have just mentioned them, with soldering irons. There are two main types — uncontrolled mains heated and temperature controlled, either mains or low voltage AC or DC.

Whichever one you get you will be able to undertake the same work. Buy an iron with interchangeable bits, and get a spare one to go with it. You should have one small — one to 2mm — and one medium — 2 to 4mm.

The names to look out for are: Adcola, Antex, Erasa, Oryx, and Weller for mains uncontrolled and add Ungar to the list for controlled irons. Prices range from £4.50 to £8.00 for mains and from £12 to £40 for controlled. An iron should last a lifetime, only the bits need be changed.

You can't really go wrong with solder, but having said that do not buy acid flux type. Use 60/40, tin/lead in 22swg, which is generally available. To unsolder use desoldering braid. It is easier and cheaper than a solder sucker. I have found Multicore Solder Wick to be the best although there are other makers such as Spirig and WIK-IT. The worst, without a doubt, is the one made by RS Components.



Next on the list are pliers and cutters. These can be bought separately or as a set. Either way will do. Find the ones which suit you best by trying them out.

The pliers should be pointed nose with either plain or serrated jaws. The cutters ought to be lightweight, either side or diagonal cutting for the best results. Manufacturers include Arhoso, Barco, CK, EPE Corporation, Erim, Lindstrom Proto, Wilkinson and Xcelite. The prices range from £2 to £8 for pliers and from £4 to £15 for cutters.

For cutting heavier guage wire and pins I suggest a purpose built cutter and stripper as the light cutters can easily be damaged on the harder materials. Prices range from £1.50 to £5.00 and most are usually good value, and most of the makers of pliers and cutters produce these.

It is most important to buy the best when it comes to screwdrivers. Sets are too expensive and usually contain too many sizes. Changeable blades are a waste of time in my opinion, if you are using different heads and screw sizes. For slotted screws you will only need four sizes at the 3, 4, 5, 6.5mm marks. All should have 8-12cm long blades.

When it comes to the crossheads it is important to match the head with the driver. There are two main types — Phillips and Pozidriv. Pozidriv now have Supadriv, but the difference is only cosmetic. If you use screws in your work please make sure that they are Pozidriv, as they are much more reliable than Phillips. Two sizes will do for each type and it is best to make the smaller ones nice and small to fit the recessed screws. There are too many names to mention so shop around. Individual prices below £1 are good value.

Allen keys, which are really hexagonal keys, are also very handy and come in very reasonably priced sets. It is worthwhile getting both Imperial and Metric.

Small spanners are very useful for tightening up nuts as the use of pliers is not to be encouraged. Again, there is no standard and in fact this time there is a choice of three: Imperial, American and Metric.

The common Imperial sizes are 4 and 6BA, 2 and 8BA only occasionally being used. The American sizes are 3/16"AF, 1/4"AF and 5/16"AF. All are commonly used. The Metric nuts come in M2.5, M3, M4, and M5. Again the middle two are most common. The safest method of purchase is to get an adjustable spanner.

There are several types of spanner, the most common being the open ended. Nut drivers are handy but pricey, as are ring spanners. However, do not make do with the wrong sizes. As with crosshead screws you will only damage both tool and component. Some spanner makers are: Bedford, Bahco, Eclipse, Elora, Footprint, and King Dick. Prices extend over a great range, from 50p to £3 for nut drivers and shifting spanners. Value for money comes at about midrange.

If you are going to expand your construction projects you will undoubtedly need a comprehensive set of tools.

BY KEITH MOTT

Make the most of your Sinclair ZX Computer...

Sinclair ZX software on cassette.

£3.95 per cassette.

sinclair ZX81
SOFTWARE
JUNIOR EDUCATION 2
BUSINESS & HOUSEHOLD 3
GAMES 4
ORBIT
SNIPER
METEORS
LIFE
WOLF PACK
GOLF
1K RAM
1
sinclair ZX81

The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with other programs to form a single-subject cassette.

Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

Although primarily designed for the Sinclair ZX81, many of the cassettes are suitable for running on a Sinclair ZX80 – if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer augmented by a 16K-byte add-on RAM pack.

This RAM pack and the replacement ROM are described below. And the description of each cassette makes it clear what hardware is required.

8K BASIC ROM

The 8K BASIC ROM used in the ZX81 is available to ZX80 owners as a drop-in replacement chip. With the exception of animated graphics, all the advanced features of the ZX81 are now available on a ZX80 – including the ability to run much of the Sinclair ZX Software.

The ROM chip comes with a new keyboard template, which can be overlaid on the existing keyboard in minutes, and a new operating manual.

16K-BYTE RAM pack

The 16K-byte RAM pack provides 16-times more memory in one complete module. Compatible with the ZX81 *and* the ZX80, it can be used for program storage or as a database.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.

ZX 16K BYTE RAM PACK
X81

Cassette 1 – Games

For ZX81 (and ZX80 with 8K BASIC ROM)

ORBIT – your space craft's mission is to pick up a very valuable cargo that's in orbit around a star.

SNIPER – you're surrounded by 40 of the enemy. How quickly can you spot and shoot them when they appear?

METEORS – your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

LIFE – J. H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

WOLFPACK – your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

GOLF – what's your handicap? It's a tricky course but you control the strength of your shots.

Cassette 2 – Junior Education: 7-11-year-olds

For ZX81 with 16K RAM pack

CRASH – simple addition – with the added attraction of a car crash if you get it wrong.

MULTIPLY – long multiplication with five levels of difficulty. If the answer's wrong – the solution is explained.

TRAIN – multiplication tests against the computer. The winner's train reaches the station first.

FRACTIONS – fractions explained at three levels of difficulty. A ten-question test completes the program.

ADDSUB – addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DIVISION – with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

SPELLING – up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3 – Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

TELEPHONE – set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

NOTE PAD – a powerful, easy-to-run system for storing and retrieving everyday information. Use it as a diary, a catalogue, a reminder system, or a directory.

BANK ACCOUNT – a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of 'where the money goes,' and at work for expenses, departmental budgets, etc.

Cassette 4 – Games

For ZX81 (and ZX80 with 8K BASIC ROM) and 16K RAM pack

LUNAR LANDING – bring the lunar module down from orbit to a soft landing. You control attitude and orbital direction – but watch the fuel gauge! The screen displays your flight status – digitally and graphically.

TWENTYONE – a dice version of Blackjack.

COMBAT – you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

MAYDAY – in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

Cassette 5 – Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

MATHS – tests arithmetic with three levels of difficulty, and gives your score out of 10.

BALANCE – tests understanding of levers/fulcrum theory with a series of graphic examples.

VOLUMES – 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES – what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes MEAN from MEDIAN.

BASES – convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP – Volumes, temperatures – and their combinations.

How to order

Simply use the order form below, and either enclose a cheque or give us the number of your Access, Barclaycard or Trustcard account. Please allow 28 days for delivery. 14-day money-back option.

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Sinclair Research Ltd,
6 Kings Parade, Cambridge,
Cambs., CB2 1SN. Tel: 0276 66104.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. Please print
Please send me the items I have indicated below.

Qty	Code	Item	Item price	Total
	21	Cassette 1 – Games	£3.95	
	22	Cassette 2 – Junior Education	£3.95	
	23	Cassette 3 – Business and Household	£3.95	
	24	Cassette 4 – Games	£3.95	
	25	Cassette 5 – Junior Education	£3.95	
	17	*8K BASIC ROM for ZX80	£19.95	
	18	*16K RAM pack for ZX81 and ZX80	£49.95	
		*Post and packing (if applicable)	£2.95	
			Total £	

*Please add £2.95 to total order value **only** if ordering ROM and/or RAM.

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Please charge my Access*/Barclaycard/Trustcard no.

**Please delete as applicable.*

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Address:

CVG05

Sinclair ZX81 Personal Com
the heart of a system that grows with you.

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

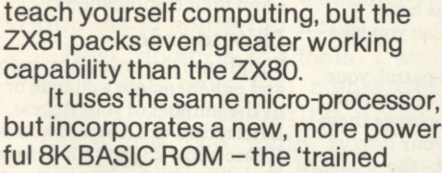
In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 50,000 in the first 3 months!

Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

Lower price: higher capability
With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, *and* to drive the new ZX Printer.



New BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.

Kit: £49.95

Higher specification, lower price – how's it done?
Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

New, improved specification
- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer.
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

Built: £69.95

Kit or built – it's up to you!
You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.

puter-

ZX 16K RAM
sinclair
ZX PRINTER
sinclair

```
10 FOR I=1 TO 22
20 PRINT "/"
30 NEXT I
40 PRINT AT 10,0;"----------------"
50 FOR I=0 TO 63
60 PLOT I,22+20*SIN (I/32*PI)
```

```
190 NEXT I
1000 GOTO 99
9980 REM PLO
9981 IF X<0
>255 THEN RE
9982 LET C=
9983 LET R=
9984 POKE 1
9985 POKE 1
9986 LET A$
)
9987 RETURN
9988 REM PR
TIME
9989 FOR I=
9990 FOR J=
9991 FOR K=
9992 POKE 3
(J,K+I)
993 NEXT K
994 NEXT J
```

Available now- the ZX Printer for only £49.95

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alphanumerics *and* highly sophisticated graphics.

A special feature is COPY, which prints out exactly what is on the whole TV screen without the need for further intructions.

At last you can have a hard copy of your program listings – particularly useful when writing or editing programs.

And of course you can print out your results for permanent records or sending to a friend.

Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your computer – using a stackable connector so you *can* plug in a RAM pack as well. A roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions.

16K-byte RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

With the RAM pack, you can also run some of the more sophisticated ZX Software – the Business & Household management systems for example.

How to order your ZX81
BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day.
BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access, Barclaycard or Trustcard.
EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR.

Qty	Item	Code	Item price £	Order Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (700 mA at 9V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack.	18	29.95	
	Sinclair ZX Printer.	27	59.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95

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ZX-81

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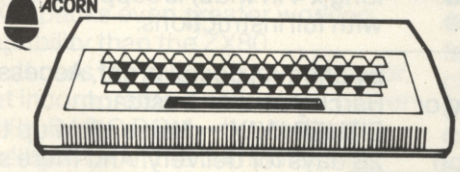

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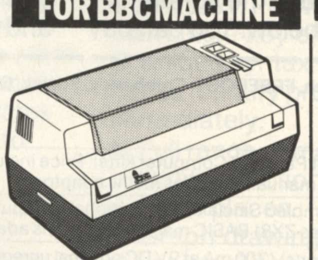

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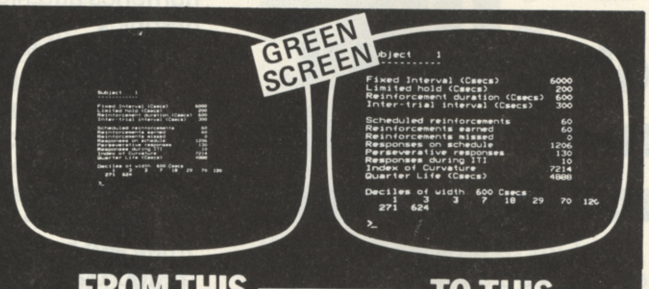

```
ubject    1
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Fixed Interval (Csecs)              6000
Limited hold (Csecs)                 200
Reinforcement duration (Csecs)       600
Inter-trial interval (Csecs)         300

Scheduled reinforcements              60
Reinforcements earned                 60
Reinforcements missed                  0
Responses on schedule               1206
Perseverative responses              130
Responses during ITI                  10
Index of Curvature                  7214
Quarter Life (Csecs)                4888

Deciles of width  600 Csecs:
     1     3     3     7    18    29    70   126
   271   624

>_
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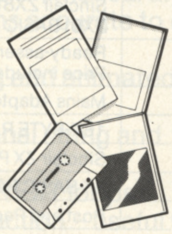

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Brainware

MIND ROUTINES

QUESTION 1
Find the first prime number greater than 5000 which is the sum of two other prime numbers.

QUESTION 2
Find a prime number such that the sum of the prime number itself and its next two consecutive numbers is also a prime number greater than 5000.

QUESTION 3
Find three prime numbers all different which add up to 5001 such that their product is maximised.

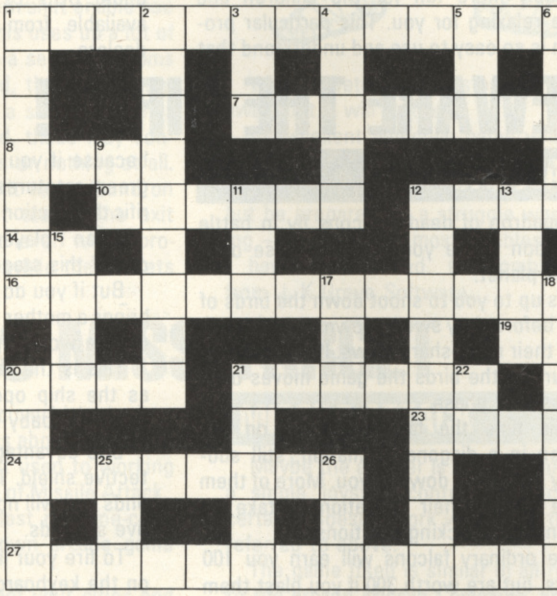
- The winners of our March Brainware problems are Stan Cartwright of Maelog Place, Gabalfa in Cardiff who was first out of the hat with a correct crossword entry, and Andrew Chandler of Downland Close, Botley, Southampton, who was first out of the hat in the Mind Routines puzzle.

Bottles of champagne are on their way to both.

More bottles can be won for the first two correct entries out of the hat for this month's problems.

Send them to: Computer & Video Games, Durrant House, 8 Herbal Hill, London EC1R 5JB. The closing date is 13 May.

NEVERA CROSSWORD



ACROSS

1. **In which to write bridge program (5, 8).**
7. **Creature created from an article on party eleven (8).**
8. **A beginner in the race ends the pinball game (4).**
10. **Souped up pretender (6).**
12. **Type of operation requiring lots of poetry (4).**
14. **Abbreviated divinity in the middle of the grid (2).**
16. **Space game where tracks are a lot misplaced (5, 8).**
19. **Greek cat noise (2).**
20. **Keep the program from the U.S.A. very carefully (4).**
21. **Tiny measurement of computer direction. Denoted by 19 across (6).**
23. **Get rid of southern basic retrieve command (4).**
24. **Asteroid battleground of endless unix poem (8).**
27. **Program explanation paper at a charge (13).**

DOWN

1. **Truth alternatives as are 3 and 4 of 12 (7).**
2. **Paper's speed string storage (9).**
3. **Record function (3).**
4. **White collar union in nominal goto (5).**
5. **Valid centre fighter (3).**
6. **RND machine man (5).**
9. **Initially the line printer disc (2).**
11. **Silicon Valley country (3).**
12. **Software company pets frequently (9).**
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17. **Clock on to the first part of this popular game (3).**
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REVIEWS

THE APPLE COMES UP TRUMPS

GERMAN WHIST

Keeping the kids amused with a computer is easy, but you end up with rather anti-social kids.

This program is the answer. German Whist is a fun card game, ideal for teaching children the rudiments of trick-taking, trumps, and all the other things they will need for playing Bridge when they enter High Society.

Getting your Apple to do the teaching is probably more fun for the children and more relaxing for you. This particular program is so easy to use and understand that it could also be a useful introduction to using the computer.

The screen displays your hand of 13 cards, in good graphics, plus an indicator showing trumps, and the top card of the remaining pack.

The Apple's hand is not visible. To play a card from your hand you simply turn the game paddles until a large flashing rectangle is over the desired card, then press the button.

The standard of play is quite good and the game is fast enough to be interesting. The program keeps a running total of games won and lost.

All told, an amusing little program without the stress building tension of the usual computer games.

German Whist runs on a 48K Apple under DOS 3.2 or 3.3, costs £9.95 and is available from principal Apple software dealers.

BEWARE THE BIRDS!

FALCONS

A squadron of deadly falcons fly in battle formation above your defence base on a lonely planet.

It's up to you to shoot down the birds of prey before they swoop down and grab you with their razor-sharp claws. If you manage to survive the birds the game moves onto the second phase.

This time the falcons appear on the screen in a diagonal formation, still suddenly swooping down at you. More of them move out of their formation to take up alternative attacking positions.

The ordinary falcons will earn you 100 points, but are worth 300 if you blast them as they swoop at you.

Beware of the falcons which reach your base level. They walk along the bottom of the screen.

Into the third phase your life gets really dangerous. The falcons have laid eggs, and these tiny blue dots invade the screen snaking their way towards you, all the time getting bigger and bigger.

It's vital to shoot them down while they are in their early stage of development because if you don't they grow into huge green creatures capable of the most horrific destruction. They are worth 200 points.

When I played it, I was unable to come out of this stage of the game alive.

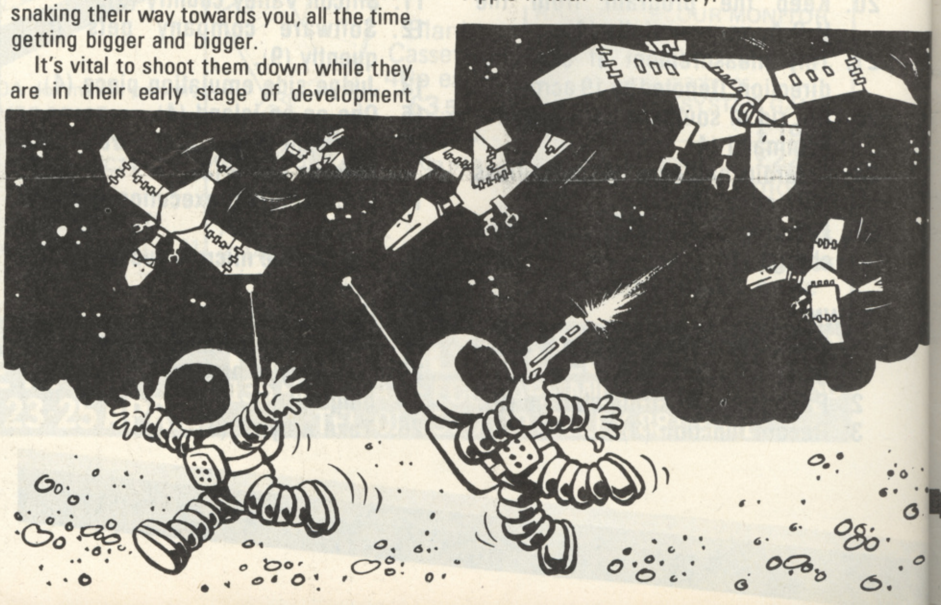
But if you do manage it the fourth stage brings a mother ship on to the screen which can be worth up to 9000 points.

This is the most hazardous phase of all as the ship opens up a hatch and drops scores of baby falcons on top of you.

One advantage the player has is a protective shield. This only lasts for four seconds and will not operate again for another five seconds.

To fire your laser beam press the 0 key on the keyboard, the 1 key to activate the protective shield. A joystick or the arrow keys are used to move your base ship.

This is one of the latest offerings from Richmond based SBD Software who specialise in Apple games imported from the States. Falcons costs £18 and is for an Apple II with 48K memory.



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REVIEWS

UNDERGROUND HAUNT FOR MONSTERS

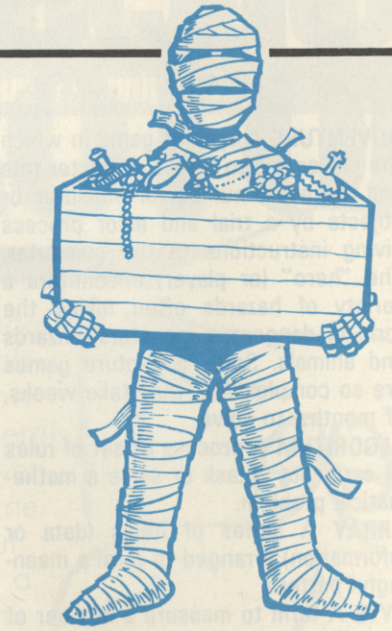
CATACOMBS

Prowling around the Catacombs in search of gold you suddenly come across an evil looking monster — will you get the gold before the monster gets you?

The aim of Catacombs is to find as much gold as possible before you run out of food of are caught by one of a variety of creatures. It runs on a ZX81 in 16K.

Keys 1 to 8 move you in the direction indicated on the keys — 1 to 4 move you diagonally. Keys 5 to 8 with shift enable you to tunnel, but beware, this uses up a lot of your food. As you move a series of rooms and passages will unfold, these may contain food. As you move a series of rooms and passages will unfold, these may contain food. gold, monsters or nothing at all.

There is always an exit to be found on each level if things get tough. The exit takes you to a different level, which provides a breathing space while the ZX sets this up.



When meeting a monster you can run away, but it will follow.

An excellent addictive game which will keep you amused for hours. For £4.95 it is certainly worth adding to your collection, but be prepared for a struggle when loading — certainly the most troublesome that I have encountered. Catacombs comes from J. K Greye Software.

MISSILES MISS TARGET

MISSILE ATTACK

Man the Bunkers! Take cover! It's the four minute warning! Which is about the length of time one needs to get used to working the controls in this game of Missile Attack.

This game is a very fast machine-code program of the well-known arcade game Missile Command.

The object is to protect your cities and missile bases from the onslaught of countless enemy missiles. This is attempted by firing your own missiles to intercept the enemy rockets prior to them making a successful strike. Each of your bases to start with has a total of nine missiles.

The graphics, while fast, leave quite a lot to be desired. The movement of the tracks of missiles across the screen is accomplished in a weird eye-wrenching zig-zag fashion which detracts greatly from concentration. Also, the use of the numeric keypad to control the movements of the Cursor — by using the figures 7, 8, 9, 4, 6, 1, 2 and 3 — is laborious and time-consuming.

Much time — and many games — can be lost just by glancing down to try to discover which key you have been operating which successfully lost you your last city and two of your bases.

Missiles are launched by using the keys Z, X and C and once again, valuable time can be lost by glancing down to verify which one is being pushed.

Maybe the answer is the introduction of a single joystick control — because it certainly doesn't work well using the keys referred to above.

The game itself is similar in all respects to the arcade Missile Command, and apart from the "wobbles" and the lack of full control, it plays quite well and fast.

The page of instructions is not held on the screen for long enough for the average reader to assimulate full details of the operating system. This blips up for a grand total of four seconds, and as a consequence of this, it does take a while to work out which keys are supposed to operate which function of the game.

There are no written instructions provided. Also the quality of the leaflet that came with the game is very poor.

For the sum of £13.95 it is not good value and I'm rather surprised that the price exceeds the £2.50 I expected. On second thoughts I think I'd prefer to continue visiting my local arcade!

On the whole it's a game which would only maintain a slight interest, you might even play it twice then shove it away and forget about it until you can overcome the cumbersome controls. It runs on a Pet, from Softprint, in New Malden.

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SOFTWARE GLOSSARY

A beginner's guide to plain jargon

ADVENTURE A type of game in which the player has to take a character role and retrieve a number of treasures or objects by a trial and error process giving instructions to the computer. The "hero" (or player) encounters a variety of hazards often taking the form of dangerous monsters, wizards and animals. Some adventure games are so complex that they take weeks, or months, to solve.

ALGORITHM A process or set of rules to carry out a task or solve a mathematical problem.

ARRAY A series of items (data or information) arranged to form a meaningful pattern.

BYTE A term to measure a number of Bits (Binary digiTS), usually eight bits to a byte.

CHARACTER STRING A sequence of characters in a row.

COMMAND In writing programs this word refers to an instruction word which specifies an operation which the computer must perform.

CONVERSATIONAL SCROLLING Data displayed on the screen involving step-by-step communication between the user and the computer.

DEDICATED CHIP A chip (microprocessor) which has been specially programmed to perform a single or special group of applications, e.g. computer games. ROMs are usually the means by which dedicated chips are developed.

DISC A magnetic storage device.

DISC DRIVE A unit which is connected to the computer, used for loading the information stored on discs into the computer.

EUROCARD A type of printed circuit board suited to circuits with a large number of chips.

FLOATING POINT This is a notation used for the calculation of numbers in which the arithmetic point, binary or decimal, is movable but not necessarily the same for each number.

FUNCTION A special purpose or characteristic action.

HIGH RESOLUTION GRAPHICS A method of using Basic commands to move a drawing head to any position on the screen drawing a line between two specified points.

INTEGER A number which does not contain a decimal point, i.e. a whole number.

INTERACTIVE A word used to describe a system which is capable of real-time man-machine communications.

JUMP An instruction which causes the next instruction executed to be the one specified by the jump instruction. A jump can be conditional, where it will branch only if a specified condition occurs. Otherwise, execution will continue to the next instruction following the jump instruction.

L.C.D. (Liquid Crystal Display) A display containing liquid crystals which light up when electricity touches them. Used in calculators and watches.

L.E.D. (Light Emitting Diode) Provides a simple display and consists of an electron tube which lights up when electricity is passed through it.

LOOP A Basic function referring to the repeated execution of a series of instructions for a fixed number of times.

MACHINE CODE The term used to refer to symbols or numbers assigned to parts of a machine.

MAINFRAME COMPUTER The jargon work used to describe a very large computer.

MONOCHROME COMPUTER DISPLAY A display screen used in a computer which shows a picture in one tone or black and white only.

NESTED SUBROUTINE A subroutine which is called within another subroutine.

NUMBER CRUNCHING The operation in computing which carries out the arithmetic and logical processes which information has to go through.

OUTPUT Data which is emitted from a computer system.

PEEK A statement used in Basic which allows you to read the contents of a specified memory address.

POKE An instruction used in most versions of Basic allowing you to store integers in a specific place in memory.

RANDOMISE A Basic command referring to the procedure for making numbers, data, or events occur at random.

REAL TIME This is on-the-spot computing when the operation is performed during the time an event is taking place in time to influence the result.

ROUTINE A set of coded computer instructions used for a particular function in a program.

VARIABLE A symbol whose numeric value can be changed at all times. It is used when writing programs.

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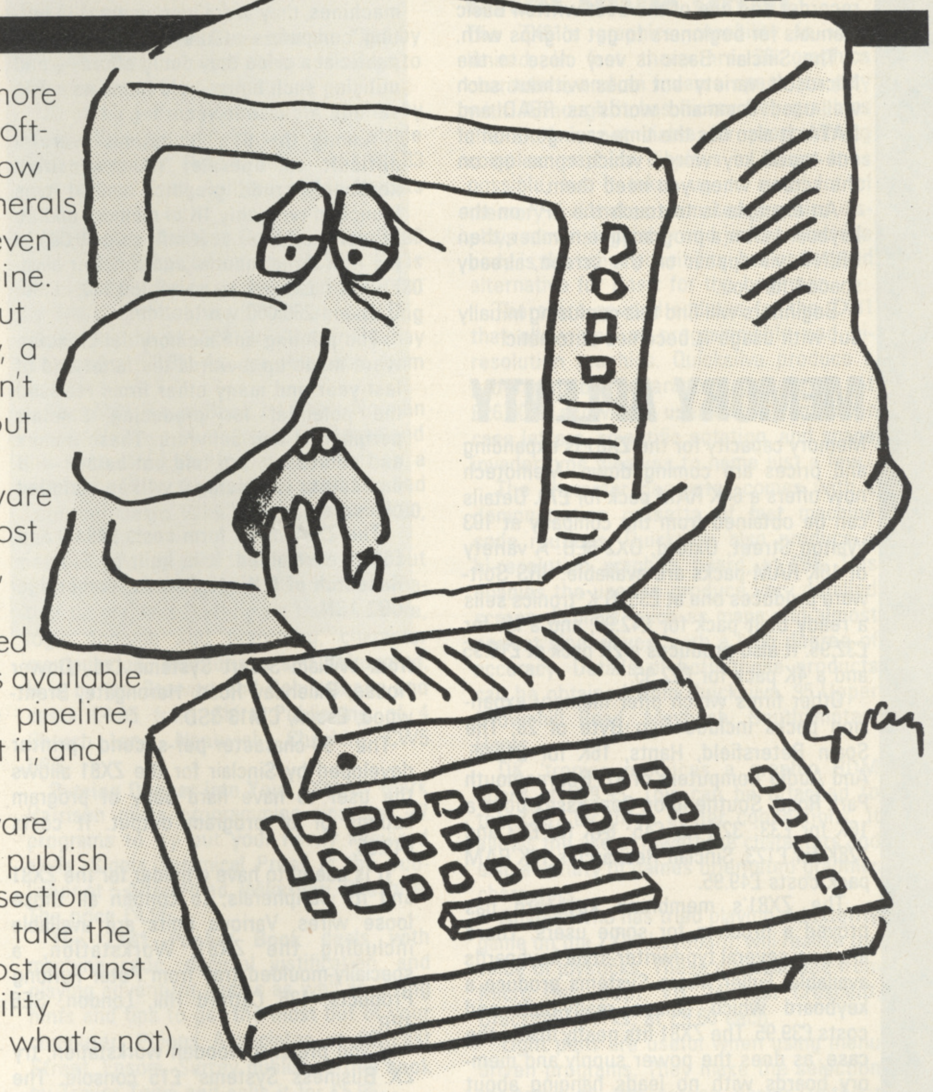

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HARD

In the spring of 1980, home computing was lifted out of the realms of the expensive hobbyist market and offered to a receptive public.

The Sinclair ZX80 was the reason and it was superceded the following year by the ZX81 model. Love or hate these machines, they were instrumental in putting computers at the fingertips of the public at a price they could afford — and utilising such house-hold items as a T.V. set and a cassette recorder.

Among the 81's limitations were a difficult to operate, touch-sensitive keyboard, crude graphics and it was launched with only 1K of memory and no printer facilities . . . it still sold 50,000 in the first three months and Sinclair ownership has now risen to 150,000 in the U.K. and 260,000 worldwide.

The printing and memory deficiencies were made up towards the latter end of last year and many other firms realised the potential for producing Sinclair peripherals and software. These names and addresses, are laid out below — if an address is missing it will be included elsewhere.

The ZX81 in kit form costs £49.95 and £69.95 assembled. It is built by Sinclair Research of 6 Kings Parade, Cambridge CB2 1SN.

ONE TOUCH WORDS

The Sinclair is based around a Z80 microprocessor, and for your money you will initially receive a startlingly small, light, box with a "Qwerty" keyboard on it, a power pack, leads for a television and cassette recorder and one of the best written Basic manuals for beginners to get to grips with.

The Sinclair Basic is very close to the Microsoft variety but does without such well-used command words as READ and DATA. It also has the time-saving notion of one-touch key words which come up on the screen when you need them.

An example is to touch the "P" on the keyboard after a program line number, then PRINT will appear on the screen, already spaced for you.

Beginners will find this confusing initially but with usage it becomes automatic.

MEMORY APLENTY

Memory capacity for the ZX81 is expanding and prices are coming down. Memotech now offers a 64K RAM pack for £79. Details can be obtained from the company at 103 Walton Street, Oxford, OX2 6EB. A variety of 16K RAM packs are available. JRS Software produces one at £35. D K' tronics sells a ready built pack for £42.95, and a kit for £32.95. It also produces a 2K pack at £15.95 and a 4K pack for £22.95.

Other firms which offer memory expansion packs include Byg Byte of 28, The Spain Petersfield, Hants, 16K for £42.95. And Audio Computers of 87, Bournemouth Park Road, Southend-on-Sea, Essex does a 16K for £33; 32K for £45; 64K for £73 and 128K for £123. Sinclair Research's 16K RAM pack costs £49.95.

The ZX81's membrane keyboard has proved a problem for some users. There are now several typewriter-style keyboards available. Fuller Micro Systems produce a keyboard which comes ready-built and costs £39.95. The ZX81 fits neatly inside the case, as does the power supply and memory boards with no leads hanging about outside. Details from Fuller Micro Systems, The ZX Centre, Sweeting Street, Liverpool.

DK 'tronics also produces a keyboard, at £27.95. Redditch Electronics produces a keyboard in kit form for £20.50. A keyboard connector is optional and costs a further £1.95. D K Computer Keyboards produces a keyboard, at £28.95.

Voice recognition and music are possible on the ZX81. William Stuart Systems produces a speech recognition system for the ZX81 called Big Ears. It allows speech input through a microphone provided with the system, and costs £49. It also produces a music synthesiser which can be used to put out sound effects and music. Through its input and output lines the ZX81 can monitor a home security system and control a robot arm. Details can be obtained from William Stuart Systems Ltd., Dower House, Billericay Road, Herongate, Brentwood, Essex, CM13 3SD.

The 50-character-per-second printer developed by Sinclair for the ZX81 allows the user to have hard copy of program listings or of program output. It costs £49.95.

It is useful to have a holder for the ZX81 and its peripherals, to contain all those loose wires. Various units are available including the ZX81 Workstation, a specially-moulded tray from Peter Furlong Products, 125 Catford Hill, London, SE6 4PR.

If you prefer a wooden workstation, try ZX Business Systems' £15 console. The address is 14 Brookfield Garden, Ryde, Isle of Wight.

ARE YOU GAME?

There is no shortage of software for the ZX81 from independent suppliers.

Many firms have set up producing both business and games for the machine but the standard of some of these is very poor.

Sinclair Research itself sells four tapes of programs which users have submitted to the firm. Included in the range is a tape containing six games, Orbit, Sniper, Meteors, Life, Wolf Pack and Golf. There is a junior education tape, and a business and household management tape. You can buy the tapes mail order from Cambridge based Sinclair for £3.95 each.

Many of the firms are small, one-man outfits which operate on a mail order basis. Prices for software range from £3 to £10 and the more you pay the better the quality tends to be.

The main firms involved in software production are: Bug Byte, 98-100 The Albany, Old Hall Street, Liverpool L3 9EP. This firm has about a dozen games on its books including versions of most of the popular arcade games like asteroids, space invaders as well as an adventure game. It also supplies a multi-purpose filing program, a machine code program, and a disassembler/debugging program.

Artic Computing, 396 James Reckitt Avenue, Hull HU8 0JA has a trio of adventure games for the ZX81 with 16K.

Premier Publications, 12 Kingscote Road, Addiscombe, Croydon, is a games supplier offering a wide range of generally good quality. The prices start at just under £4.

Quicksilva, 95 Upper Brownhill Road, Maybush, Southampton currently has three well presented games on the market. They are all versions of popular arcade games, space invaders, defender and asteroids and all cost £5.50.

Silversoft, 40 Empress Avenue, Ilford, Essex produces games for the ZX81 with a starting price of £4.95.

Macronics, 26 Spiers Close, Knowle, Solihull, West Midlands. This firm has nine games on sale which start at £3.95 going up to £6.95. Games included are space invaders, breakout and a music pack.

DK 'tronics, 23 Sussex Road, Gorleston, Great Yarmouth, Norfolk, offers centipede, a version of the recent arcade game, and a 3D labyrinth game. Prices start at £3.95.

Micro-Gen, 24 Agar Crescent, Bracknell, Berkshire, is a small firm supplying a couple of games for the ZX81, including a chess program, for £6.50.

Humorous games come from Automata, 65A Osborne Road, Portsmouth, Hampshire. Advertised as suitable for adults only, the series of three starts at £3.

J. K. Greye Software, 16 Park Street, Bath, Avon BA1 2TE produce a range of games with a lot of variety. Lowest price is £3.95.

Psion Computers, 20 Clifton Court, Maida Vale, London NW8 8HT, sells sci-fi fantasy games based on the adventure concept. Again the price is low at £3.85.

Other suppliers are: Axis, 71 Brookfield Avenue, Loughborough, Leics; J. O'Connor, 5 Tennison Close, Bolton-Le-Sands, Lancaster; Bridge Software, 36 Fernwood, Marple Bridge, Stockport, Cheshire, SK6 5BE; Giltrole, PO Box 50, Rugby, Warwickshire, CV21 4DH; Michael Orwin, 26 Brownlow Road, Willsden, London, NW10 9QL; Second Foundation, 22 Bramber, Belgrave, Tamworth, Staffordshire, B77 2LL; Control Technology, 39 Gloucester Road, Gee Cross, Hyde, Cheshire, SK14 5JG; Timedata, 57 Swallowdale, Basildon, Essex;

CORE

JRS Software, 19 Wayside Avenue, Worthing, Sussex; Video Software, Stone Lane, Kinver, Stourbridge, West Midlands and Richard Shepherd Software, 22, Green Leys, Maidenhead, Berks.

A USER'S STORY

What's the user's view of the ZX81? Well! To set up the computer it is much like any other, fairly easy if you read the manual. It is when you come to type in a program that the trouble starts. The membrane keyboard is difficult to get along with, especially if you are used to a regular keyboard. Most people I have talked to heartily dislike it as well. I found the keyword system slow and awkward to use at first.

If you are new to computing don't bother to use the manual that comes with the unit. I found it easier to grasp the basic principles using a book like the **ZX81 Basic Book**.

A lot has been said about loading problems, but I have not encountered very many. For the record, I use a Ferguson 3T15 portable cassette player.

All sorts of hard and software is becoming available for the ZX81 and it must be said that some of it is of dubious quality. Buy software carefully, read the reviews published in this and other magazines.

This year will see a multitude of peripherals for the ZX81. Sinclair's own printer has just become available and various bits and pieces are coming on the market monthly. Joysticks, memory packs, sound boards and desk units.

I would recommend that you join a group of local users if there is a club in your area. The interchange of ideas is invaluable. Another source of advice, programs and reviews is the National ZX81 Users Club. For details send an S.A.E. to 44-46 Earls Court Road, London W8 6EJ.

The ZX81 represents good value for money. Sinclair's product support does leave a lot to be desired especially if you mail order. Order lead times are quite long.

WEALTH OF BOOKS

A wealth of books are now on sale to help you glean every piece of information about your Sinclair machine.

Many of them cover the same subjects, like programming your ZX81, machine language and the use of subroutines, but treat the topic in varying ways. We have included a selection with comments.

The Explorer's Guide to the ZX81 by Mike Lord of software house, Timedata. It covers programming aids, lists some games, applications, machine language and goes over the hardware side and expansion. It costs £4.95 from Timedata, 57 Swallowdale, Basildon, Essex. It claims to carry on where the Sinclair manual leaves off. And for £4.75, Timedata sells the **ZX81 Magic Book**.

Getting acquainted with your ZX81 by Tim Hartnell. It contains 80 programs for the unexpanded 1K ZX81 and is available in three editions. Numbers two and three cost £3.95 and £4.95 respectively from the ZX81 user club's magazine Interface by mail order. The address is 44-46 Earls Court Road, London W8 6EJ.

And **49 Explosive Games for the ZX81** by Hartnell costs £5.25 and contains listings to program into your Sinclair.

Stretching Your ZX81 to its Limits by Trevor Sharples and Hartnell is available from **Computer Publications**, Unit 3, 33 Woodthorpe Road, Ashford, Middx. It costs £6.95.

Mastering Machine Code On Your ZX80 is by Tony Baker and it costs £5.95. So is the **Gateway Guide to the ZX81 and ZX80** by Mark Charlton for £5.95. **34 Amazing Games for the 1K ZX81** by Alistair Gourlay is priced at £3.95. All are obtainable from Interface.

The ZX81 Basic Book by Robin Norman is from Newnes Microcomputer Books and the price is £4.95. He has also written a similar book for the older machine called **Learning Basic With Your Sinclair ZX80**, costing £4.95.

Peek, Poke, Byte and RAM is about Basic programming and includes information on graphics, setting up the hardware, logic, looping and branching, character manipulation, subroutines and debugging. It is by Ian Stewart and Robin Jones and costs £4.95 from Shira Publishing of 4 Church Lane, Nantwich, Cheshire CW5 5RQ.

Byteing Deeper into Your ZX81 by Mark Harrison gives programming tips and 37 programs to try out your newly acquired skills. Sigma Technical Press is the publisher at 5 Alton Road, Wilmslow, Cheshire. The price £4.95.

The ZX81 Pocket Book deals with machine code, decimal justification, and playing adventure games as well as giving hints and tips to get the most out of your computer. Phipps Associates at 99 East Street, Epsom, Surrey publishes this book by Trevor Toms and sells it for £5.95.

Books from Kuma Computers of 11 York Road, Maidenhead, Berkshire are: **Understanding Your ZX81 ROM** by Dr Ian Logan, costing £8.95.

The ZX81 Companion for £5.95. **The Sinclair ZX81 Programming for Real Applications** by Randle Hurley at £6.95. **Hints and Tips for the ZX81** by Andrew Hewson priced at £4.25. **Machine Language Made Simple** for £8.95 and **Not Only 30 Programs for the ZX81** at £6.95 but also **50 Rip Roaring Games for the ZX80/81** for £4.95.

Finally **Making the Most of Your ZX80** by Tim Hartnell is obtainable through Interface and the following shops: Timedata, 37 Swallowdale, Basildon, Essex; Foyles Bookshop, Charing Cross Road, London WC2; Syntax Software, 96 Collinwood Gardens, Ilford, Essex; The Software House, 146 Oxford Street, London, W1; Mine of Information, 1 Francis Avenue, St Albans, Hertfordshire; Sinclair Research, 6 Kings Parade, Cambridge, Cambridgeshire CB2 1SN.

GRAPHICS JAM

The ZX81's graphics capability is very limited. In fact there are 20 graphics characters, and an inverse space, to play with. Although it has flicker free graphics the ZX81 is not viable for programming complex graphics displays in Basic. It is possible, but it takes up an awful lot of memory and makes animated graphics displays move sluggishly and jerkily. Machine code is the other possibility, but not a good alternative for Basic for the beginner.

There are several add-ons for the ZX81 that allow use of programmable and hi-resolution graphics. Quicksilva produce a programmable character generator at £26.00. It allows the user to program lower case letters, scientific notation, and space invader-type meanies to name just a few.

The character generator comes with a demonstration cassette of fast machine code routines. Quicksilva also produce a hi-resolution graphics board, at £85. This enables the user to produce very detailed screen displays, such as maps and almost perfect sine waves, with a high degree of accuracy. Details of both these products can be obtained from Quicksilva, 95 Upper Brownhill Road, Maybush, Southampton, Hants.

DK 'tronics produces a graphic ROM board at £29.95. This can be attached to the ZX81 by three solder connections. It allows the use of lowercase characters and also a variety of games orientated graphics characters.

Anyone who has tried playing a dexterity game on the ZX81 keyboard, will realise the value of joysticks. These are available from Micro Gen, Dept. VG, 24 Agar Crescent, Bracknell, Berks, at £9.60 each.

Light pens are useful when using menu driven programs. They make the selection of items on the screen easier, without having to use the keyboard to input replies. RD Laboratories produces the "Doodler" at £32.50. Details from RD Laboratories, (Dept. Y), 5 Kennedy Road, Dane End, Ware, Herts, SG12 0LU.

For users who have difficulty with loading, the Abacus Controller should provide a remedy. At £12 the controller switches from SAVE to LOAD by turning just one switch. Details from Abacus Electronics, 186 St. Helens Avenue, Swansea, West Glam. Finally a colour programmable character generator will soon be available from Fountain Computers of Dorbill Road, Rockley, Alresford, Hants. As we went to press it was still under development and a price had yet to be fixed. But for around £90 it will let you program any character or pixel in colour.

E TO THE SINCLAIR ZX81

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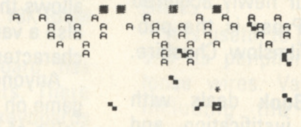
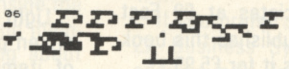
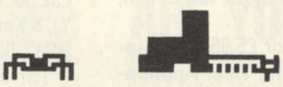


PHANTOM ALIENS



BUG SPLAT



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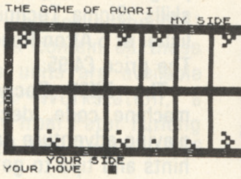
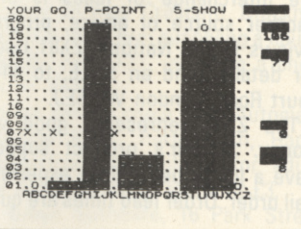
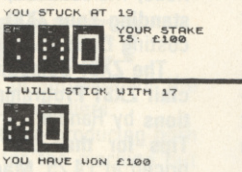


RECTANGLES

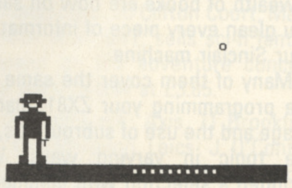


PONTOON



```
PONTOON    THE BANK HAS:   £2000
           YOUR CREDIT IS:£1000
YOU STUCK AT 19
           YOUR STAKE
           IS:  £100
I WILL STICK WITH 17
YOU HAVE WON £100
```

PENNY SHOOT



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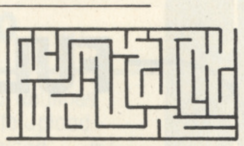

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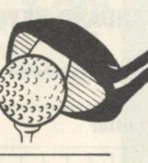

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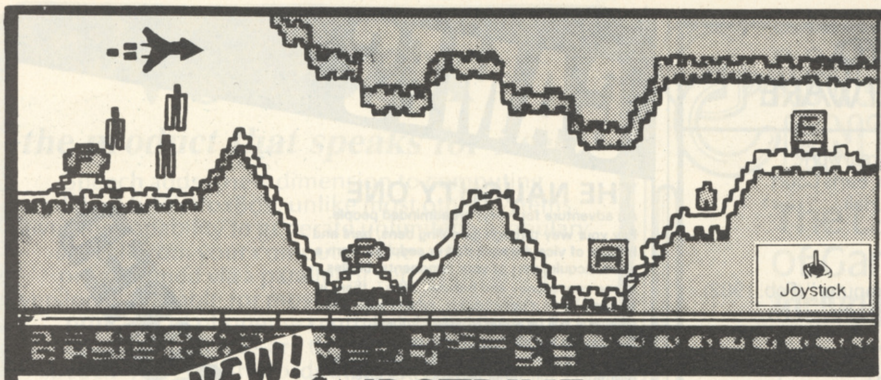

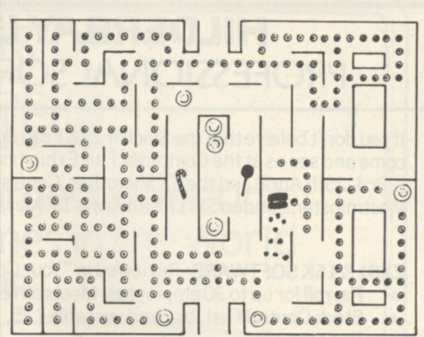

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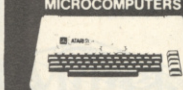

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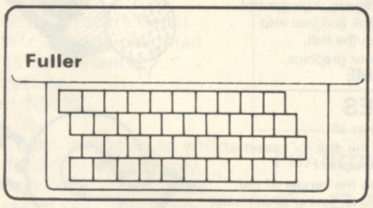

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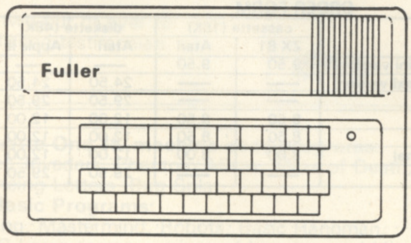

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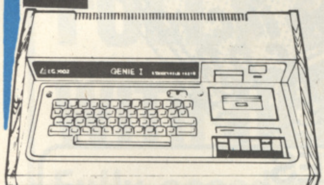

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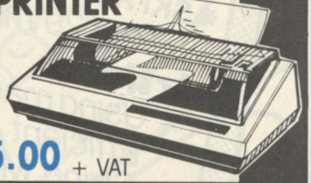

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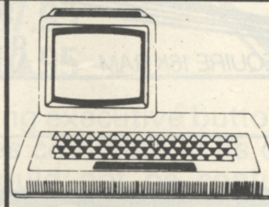

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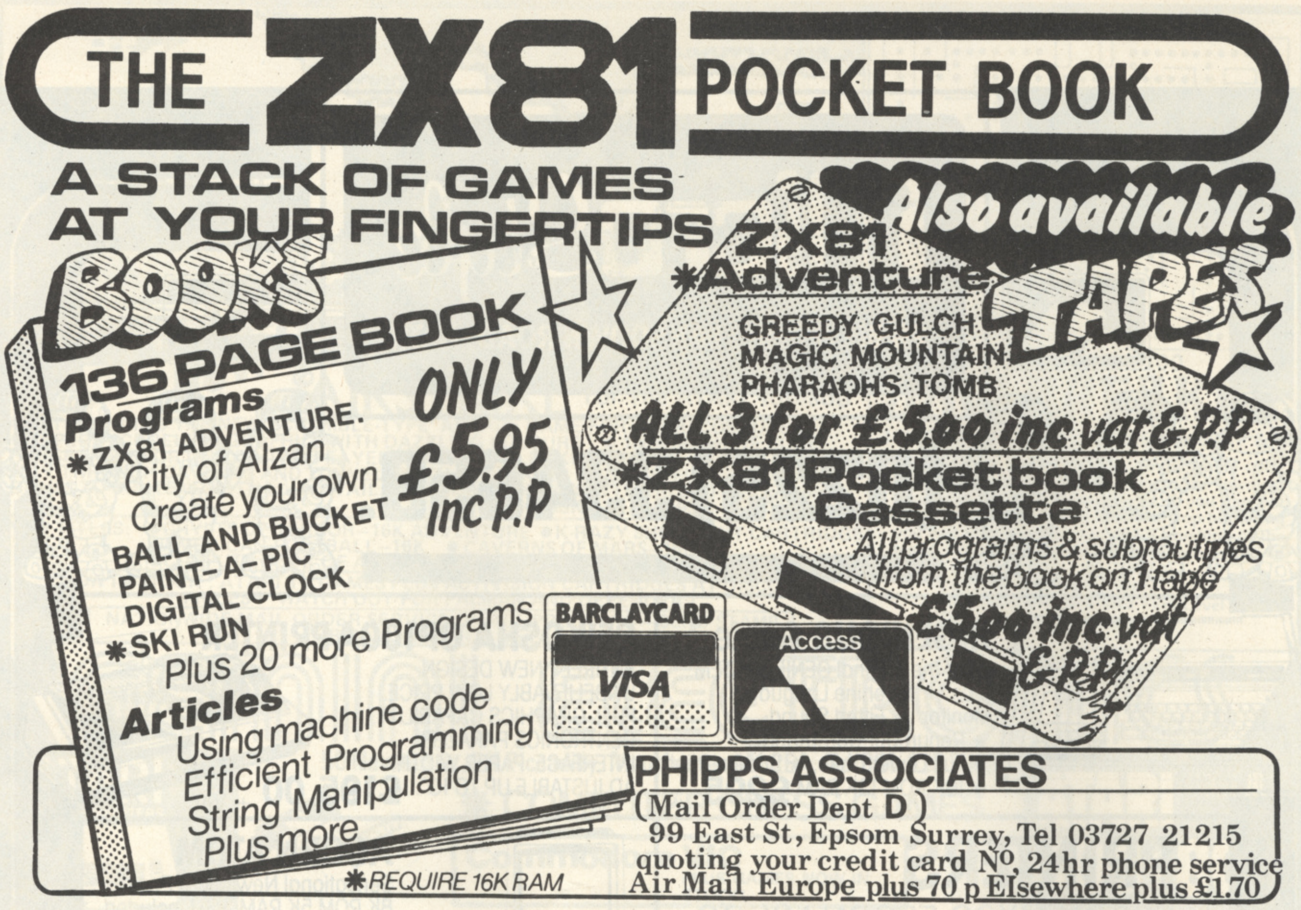

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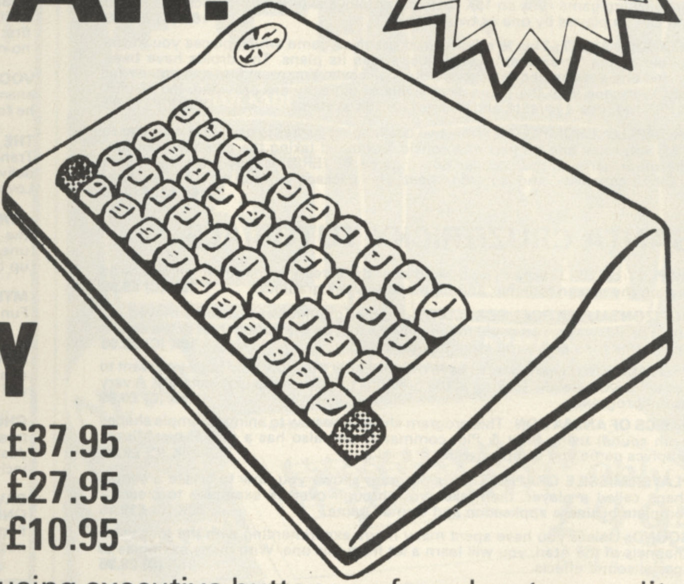

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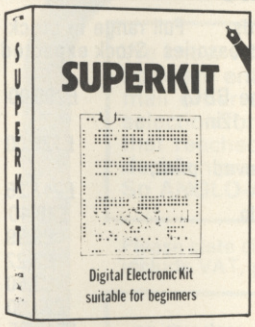

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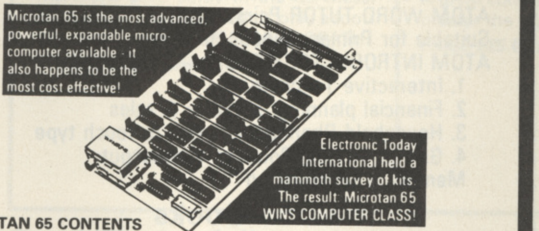

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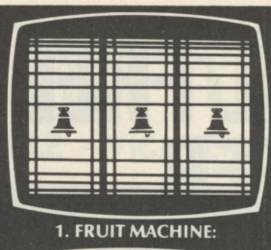
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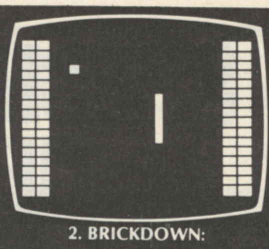
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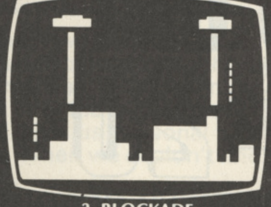
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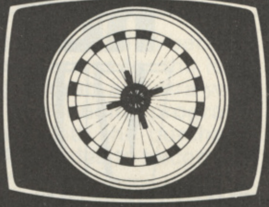
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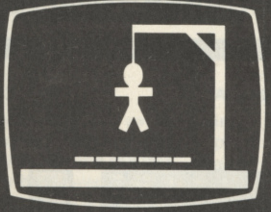
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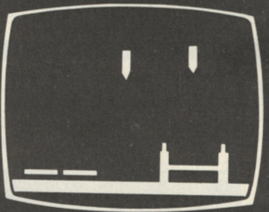
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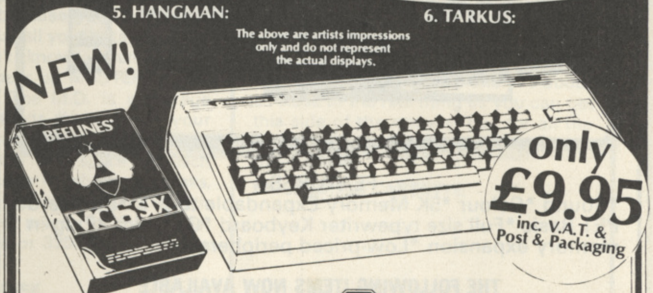

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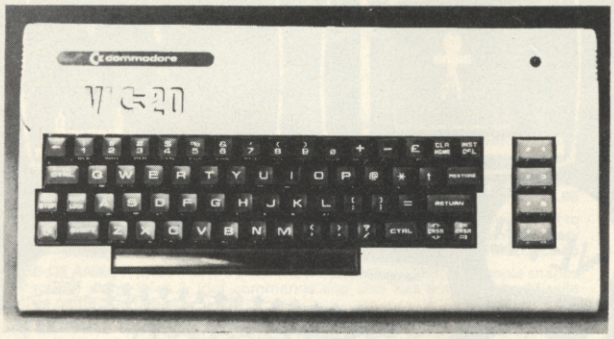

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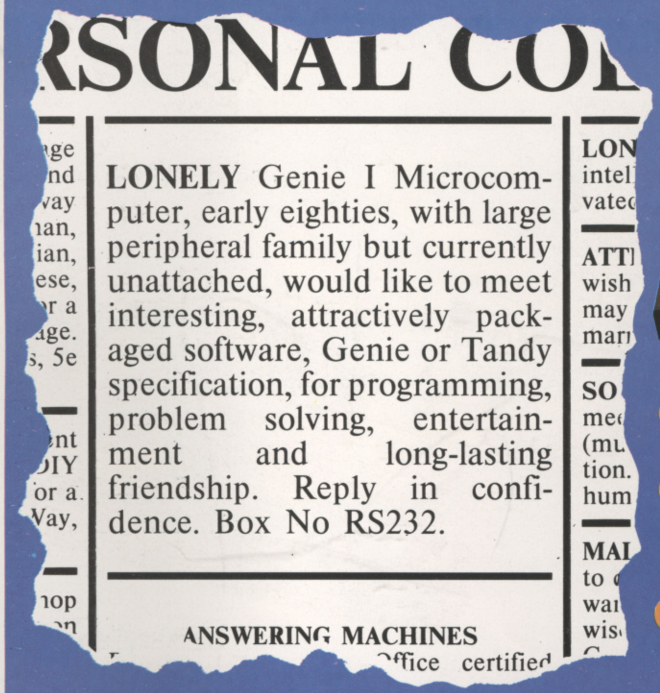

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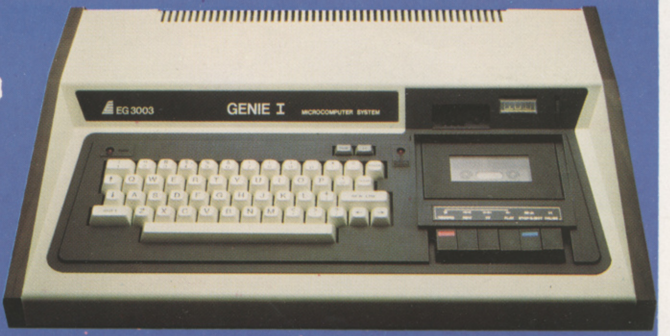

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